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EDITED BY

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ERRATA.

Vol. V.— Page 564, line 22, for *ventral* read *dorsal;* line 24, dele *and Donacia.* Page 565, line 8, for *Donacia* read *Telephorus;* line 6 from bottom, for *They are* read *Attelabus is.* Page 566, line 1 from bottom, after *while* insert *Telephorus.* Page 745, line 29, for *Raphidophora maculata* read *Ceuthophilus maculatus;* line 31, for *Raphidophora subterranea* read *Hadenœcus cavernarum.* Page 746, under cut, for *Raphidophora subterranea* read *Hadenœcus cavernarum.* Page 759, line 18, for *Raphidophora* read *Ceuthophilus;* line 23, for *R* read *H;* and for *stygia* read *Ceuthophilus stygius;* line 35, for *R. stygia* read *Ceuthophilus stygius.*

Vol. VI.— Page 45, line 9 from bottom, for TENNIFOLIUM read TENUIFOLIUM. Page 72, line 10, for *Denver* 2105 *feet above the sea* read 5105 *feet.* Page 136, line 3, for *equivalency* read *equivalence.* Page 138, line 4 of note, for *applications* read *appliances.* Page 140, line 24, for *advertency* read *inadvertency.* Page 141, line 3 from bottom, for *from* read *for.* Page 176, head line, for GEOLOGY read ZOOLOGY. Page 178, head line, for ZOOLOGY read GEOLOGY; line 18, for *Chantauqua* read *Chautauqua.* Page 187, line 18, insert *S.* before *Beale.* Page 192, line 4 from bottom, for 321 read 317. Page 237, line 9 from bottom, for *Danus* read *Danaus.* Pages 286–289, for *Urella* read *Uvella.* Page 283, line 30, for *glauconia* read *glaucoma.* Page 350, line 3, for *Leucosticta griseinucha* read *L. tephrocotis.* Page 327, place § before last note. Pages 327 and 329, in the last square of the upper row insert a *comma* after *binocular.* Page 374, line 25, for *Dongall* read *Dougall.* Page 515, line 15, for *W. Doubleday* read *Mr. Doubleday;* last line but one, for *even unite their faces* read *ever unite their forces.* Page 516, line 6, for *enclosed* read *eclosed:* line 9, for *there* read *then;* line 16, for *trace* read *traces.*

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CONCERNING DEEP-SEA DREDGINGS.

BY PROF. L. AGASSIZ.*

MY DEAR FRIEND:—On the point of starting for the Deep-Sea Dredging expedition, for which you have so fully provided, and which I trust may prove to be one of the best rewards for your devotion to the interests of the Coast Survey, I am desirous to leave in your hands a document which may be very compromising for me, but which I nevertheless am determined to write in the hope of showing within what limits natural history has advanced toward that point of maturity when science may anticipate the discovery of facts.

If there is, as I believe to be the case, a plan according to which the affinities among animals and the order of their succession in time were determined from the beginning, and if that plan is reflected in the mode of growth, and in the geographical distribution of all living beings; or, in other words, if this world of ours is the work of intelligence, and not merely the product of force and matter, the human mind, as a part of the whole, should so chime with it, that, from what is known, it may reach the unknown; and if this be so the amount of information thus far gathered should, within the limits of errors which the imperfection of our knowledge renders unavoidable, be sufficient to foretell what

*Communicated by Prof. Peirce from advance sheets of Bulletin of the Museum of Comparative Zoology. No. 3. A Letter concerning Deep-Sea Dredgings, addressed to Professor Benjamin Peirce, Superintendent United States Coast Survey, by Louis Agassiz. Cambridge, Mass., December 2, 1871.

we are likely to find in the deepest abysses of the sea, from which thus far nothing has been secured.

I will not undertake to lay down the line of argument upon which I base my statement, beyond what is suggested in the few words preceding, namely, that there is a correlation between the gradation of animals in the complication of their structure, their order of succession in geological times, their mode of development from the egg, and their geographical distribution upon the surface of the globe. If that be so, and if the animal world designed from the beginning has been the motive for the physical changes which our globe has undergone, and if, as I also believe to be the case, these changes have not been the cause of the diversity now observed among organized beings, then we may expect from the greater depth of the ocean representatives resembling those types of animals which were prominent in earlier geological periods, or bear a closer resemblance to younger stages of the higher members of the same types, or to the lower forms which take their place nowadays. And to leave no doubt that I have a distinct perception of what I may anticipate, I make the following specific statement.

It lies in the very nature of these animals that, among vertebrates, neither Mammalia nor Birds can exist in deep waters, and if any Reptiles exist there, it could only be such as are related to the extinct types of the Jurassic periods, the Ichthyosauri, Plesiosauri, and Pterodactyles, but even of these there is very little probability that any of their representatives are still alive. Among the fishes, however, I expect to discover some marine representatives of the order of Ganoids of both the principal types known from the secondary zoological period, such as Lepidoids, Sauroids, Pycnodonts, Cœlacanthes, Amioids, and Glyptolepis-like species may even be looked for. Among Selachians some new representatives of Cestraciontes or Hybodontes may be forthcoming, connecting the latter more closely to Odontaspis. I also look forward to finding species allied to Corax, or connecting this genus with Notidanus, perhaps also Jurassic-like forms. Among Chimæroids we may expect some new genera more closely related to the extinct types of that family than those now living. Among ordinary fishes I take it for granted that Beryx genera may be added to our list, approaching perhaps Acanus or rather Sphenocephalus; also types allied to Istieus, to Anenchelum, and to Os-

meroides, Elops, and Argentina. Dercetis and Blochius may also come up. Species of all classes of the animal kingdom which have been very rarely met with by fishermen and naturalists are likely to be found in the deepest waters, in which neither hooks nor nets are generally lowered. Nothing is known concerning the greatest depth at which fishes may live. Upon this point I hope to obtain positive data.

The Mollusks will, no doubt, afford a rich harvest of novelties, among which some may be of the deepest zoological interest. It stands to reason that a variety of Nautiloid Cephalopods may be discovered when Nautilus proper and Spirula are so rarely found alive, and among new forms there may be those combining characters of Argonauts with features of Nautilus; some may even be coiled up like Turrilites. Belemnitic Squids would appear natural. Among Gasteropods we may look for high spired Natica-like types, for representatives of Acteonella, Avellana, and the like; for small Volutoids of the Tertiary and Cretaceous types, for Rostellarias, even for Nerineas, and more particularly for forms intermediate between Firulea and Cyprea. Among Acephala I would expect a variety of Myacea approaching those described in my monographs of that family from the Jurassic and Cretaceous formations, such as Ceromya, Corimya, Circomya, Goniomya, Myopsis, etc., with Panorpa and Pholadomya, and others recalling perhaps also Cardinia, Gresslya, or Cardiacea more closely related to Conocardium than the living species, perhaps leading to Opis, or Trigoniae of extinct types akin to Myophoria, with Pachymya, Diceras, Grammisia, Inoceramus, Pterinea, Monotis and Posidonia. Rudistes should take the place of oysters and the harvest of Brachiopods should be large.

Among Crustacea it is natural to suppose that genera may be discovered reminding us of Eryon or of Pemphyx, Gampsonyx, or some Amphipods, and Isopods aping still more closely the Trilobites than Serolis, or Limuloids approaching that extinct family. The classification, embryology, and order of succession of Echinoderms is now so well known, that it is perhaps still more easy to anticipate the character of discoveries in this branch of the animal kingdom than in any other. I expect confidently, to find Spatangoids approaching Holaster, Toxaster, Ananchytes, Hemipneustes or Metaporhinus, and others akin to Dysaster; Echinolamps approaching Pygurus, Nucleolites tending to Clypeus, Gal-

erites like Pyrina or Globator, etc., etc., and again Cidarid akin to *C. glandifera* and *clavigera* with Glypticus-like species, and Codiopsis, Cœlopleurus, Cyphosoma, and Salenia.

Among Starfishes the types of Goniaster and Luidia are likely to prevail with simple rayed Euryaloid genera, and among Crinoids a variety of genera reminding us of Pentremites, Marsupites, Pentacrinus, Apiocrinus, and Eugeniacrinus.

The question of the affinities of Millepora will probably receive additional evidence, and genera connecting more closely the Rugosa and Tabulata with one another, and with the Acalephs may be expected in the shapes of branching Heliopores and the like.

With the monograph of Pourtales upon the deep-sea corals before me, it would be sheer pretence to say anything concerning the prospect of discovering new representatives of this or that type. His tables point them out already.

But, there is a subject of great interest likely to be elucidated by our investigation,—the contrast of the deep-sea faunæ of the northern with those of the southern hemisphere. Judging from what Australia has already brought us, we may expect to find that the animal world of the southern hemisphere has a more antique character, in the same way as North America may be contrasted with Europe, on the ground of the occurrence in the United States of animals and plants now living here, the types of which are only found fossil in Europe.

A few more words, upon another subject. During the first three decades of this century, the scientific world believed that the erratic boulders, which form so prominent a feature of the surface geology of Europe, had been transported by currents arising from the rupture of the barriers of great lakes among the Alps or started from the north by earthquake waves.

Shepherds first started the idea that within the valleys of Switzerland these huge boulders had been carried forward by glaciers, and Swiss geologists, Venetz and Charpentier foremost among them, very soon proved that this had been the case. This view, however, remained confined to the vicinity of the Alps in its application, until I suggested that the phenomenon might have a cosmic importance, which was proved when I discovered, in 1840, unmistakable traces of glaciers in Scotland, England, and Ireland, in regions which could have had no connection whatever with the elevation of the Alps. Since that time the *glacial period*

has been considered by geologists as a fixed fact, whatever may have been the discrepancies among them as to the extent of these continental masses of ice, their origin, and their mode of action.

There is, however, one kind of evidence wanting to remove every possible doubt that the greatest extension of glaciers in former ages was connected with cosmic changes in the physical condition of our globe. All the phenomena related to the glacial period must be found in the southern hemisphere with the same characteristic features as in the north, with this essential difference, that everything must be reversed; that is, the trend of the glacial abrasion must be from the south northward; the lee side of abraded rocks must be on the north side of hills and mountain ranges, and the boulders must have been derived from rocky exposures lying to the south of their present position. Whether this is so or not, has not yet been ascertained by direct observation. I expect to find it so throughout the temperate and cold zones of the southern hemisphere, with the sole exception of the present glaciers of Terra del Fuego and Patagonia, which may have transported boulders in every direction. Even in Europe, geologists have not yet sufficiently discriminated between local glaciers and the phenomena connected with their different degrees of successive retreat on one hand, and the facts indicating the action of an expansive and continuous sheet of ice moving over the whole continent from north to south. Unquestionably, the abrasion of the summits of the mountains of Great Britain, especially noticeable upon Schiehallion, is owing to the action of the great European ice-sheet during the maximum extension of the glacial phenomena in Europe, and has nothing to do with the local glaciers of the British Isles.

Among the facts already known from the southern hemisphere are the so-called rivers of stone of the Falkland Islands, which attracted the attention of Darwin during his cruise with Captain Fitzroy, and which have remained an enigma to this day. I believe it will not be difficult to explain their origin in the light of the glacial theory, and I fancy now they may turn out to be nothing but ground moraines, similar to the "Horsebacks" of Maine.

You may ask what the question of drift has to do with deep-sea dredging? The connection is closer than may at first appear. If drift is not of glacial origin, but the product of marine currents, its formation at once becomes a matter for the Coast Survey

to investigate, and I believe, it will be found in the end, that, so far from being accumulated by the sea, the drift of the lowlands of Patagonia has been worn away to its present extent by the continued encroachment of the ocean in the same manner as the northern shores of South America and of Brazil have been.

THE BLIND FISHES OF THE MAMMOTH CAVE AND THEIR ALLIES.*

BY F. W. PUTNAM.

THE blind fish of the Mammoth Cave has from its discovery been regarded with curiosity by all who have heard of its existence, while anatomists and physiologists have considered it as one of those singular animals whose special anatomy must be studied in order to understand correctly facts that have been demonstrated from other sources; and, in these days of the Darwinian and development theories, the little blind fish is called forth to give its testimony, pro or con.

Before touching upon this point, however, we must call attention to the structure of the fish and its allies, and to others that are either partially or totally blind.

In the lancelet (Branchiostoma) and the hag (Myxine) the eye is described "as simple in form as that of a leach, consisting simply of a skin follicle† coated by a dark pigment, which receives the end of a nerve from the brain." Such an eye speck as this structure gives would only answer for the simple perception of light. In the young ‡ of the lampreys (Petromyzon) the eye is very small and

* It was intended to put this article in the last number of the NATURALIST in connection with the article on the cave and its insect and crustacean life, but the delay in preparing the plates made it necessary to postpone it. We are therefore obliged to refer the reader to the December number for further information of the fauna of the cave and a short account of the cave itself. — EDS.

† See further on where Prof. Wyman questions this structure.

‡ These young lampreys have been described under the generic name of Ammocœtes, and it was not until 1856, when Prof. Müller discovered the fact of a metamorphosis in the lampreys, that their true position was ascertained. Prof. Müller has traced the history of the common European species and shown that it is three or four years in attaining its perfect form. With this fact before us and with the early stages of the Myxinoids still unknown, have we not some reason for suspecting that the Lancelet may yet prove to be a larval form of the Myxinoids, notwithstanding that it is said to lay eggs? Why should we not suspect the existence in the very lowest vertebrates of some-

placed in a fold of the skin of the head, and probably of little use, as these young remain buried in the sand; but as they attain maturity, and, with it, the parasitic habits of the adult, their eyes are developed to a fair size, thus reversing the general rule in the class.

In most other fishes the eyes are developed to a full and even remarkable extent as to size and perfection of sight in water. In Anableps, or the so called four eyed fish of the fresh waters of Central and South America, which belongs to a closely allied family with our blind fish, the *Cyprinodontidæ*, the eyes are not only fully developed, but are divided into an upper and lower portion in such a way, by an opaque horizontal line, as to give the effect of two pupils, by which the fish probably sees as well when following its prey on the surface with its eyes out of water, as when under water. But it is in the interesting family of cat fishes (*Siluridæ*) that we find the most singular arrangement of eyes in perfect adaptation to the diversified modes of life of the numerous species. In this family the eyes assume nearly every possible modification from partial and even total blindness to perfectly developed eyes, and these organs are placed in almost every conceivable position in a fish's head; from the ordinary large eyes on the side, to small ones on top of the head, enabling the fish to see only what is above; to the oval eyes on the side, in some just back of the mouth, situated in such a way that the fish can only see what is in close proximity to its jaws or even below them. Many genera of this family found in South America,* Africa† and Asia,‡ have the eyes so small and buried under the skin or protected by folds or cartilage, as evidently to be of no more use than simply to distinguish light from darkness.

Among the most interesting forms of this family, in this respect, is the genus described by Prof. Cope under the name of *Gronias nigrilabris*. This fish is very closely allied to our common bull

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thing akin to alternate generations, or of larvæ capable of reproduction? Without having any facts to support such an assumption, except that, on general principles, the young of Myxine would probably be very much like Branchiostoma, and that its young is not known, while Branchiostoma has only been found in waters where some species of Myxinoid exists. I think that before the position of the lancelet is firmly established we must know the embryology of the Myxinoids; for should the lancelet prove not to be the young of the Myxinoids, it must necessarily form a distinct class of animals, perhaps as near to the mollusks as to the vertebrates.

* *Pimelodus cyclopium* of Humboldt, *Helogenes*, *Agoniosus* and other genera.

† *Eutropius congensis*.

‡ *Ailia*, *Shilbichthys*, *Bagroides* and other genera.

pout or horned pout, and of about the same size (ten inches in length). It was taken in the Conestoga river in Lancaster Co., Penn., where it is "occasionally caught by fishermen and is supposed to issue from a subterranean stream said to traverse the limestone in that part of Lancaster Co., and discharge into the Conestoga." We quote the following from Prof. Cope's remarks on the fish:* —

"Two specimens of this fish present an interesting condition of the rudimental eyes. On the left side of both a small perforation exists in the corium, which is closed by the epidermis, representing a rudimental cornea; on the other the corium is complete. Here the eyeball exists as a very small cartilaginous sphere with thick walls, concealed by the muscles and fibrous tissue attached, and filled by a minute nucleus of pigment. On the other the sphere is larger and thinner walled, the thinnest portion adherent to the corneal spot above mentioned; there is a lining of pigment. It is scarcely collapsed in one, in the other so closely as to give a tripodal section. Here we have an interesting transitional condition in one and the same animal, with regard to a peculiarity which has at the same time physiological and systematic significance, and is one of the comparatively few cases where the physiological appropriateness of a generic modification can be demonstrated. It is therefore not subject to the difficulty under which the advocates of natural selection labor, when necessitated to explain a structure as being a step in the advance towards, or in the recession from, any *unknown* modification needful to the existence of the species. In the present case observation on the species in a state of nature may furnish interesting results. In no specimen has a trace of anything representing the lens been found."

When we remember that the lens of the eye in Amblyopsis has been found, even though the eye is less developed in all its parts than in Gronias, it is probable that a careful microscopical examination would show its existence in this genus also.

It is interesting to note that this fish is black above (lighter on the sides and white below), notwithstanding its supposed subterranean habits, and that all the other members of the family having rudimentary or covered eyes are also dark colored, while the blind fishes of the Mammoth Cave and of the caves in Cuba are nearly colorless. This want of color in the latter fishes has been considered as due to their subterranean life. If this be the cause, why should the blind cat fishes retain the colors characteristic of the other members of the family living in open waters?

* Proceedings of the Academy of Natural Sciences of Philadelphia for 1864, p. 231.

The fishes which in a general way, so far as blindness, tactile sense and mode of life are concerned, come the nearest to the blind fishes of the Mammoth Cave, are those described by Prof. Poey* under the names of *Lucifuga subterraneus* and *L. dentatus*.† These fishes having the broad, flattened, fleshy head, with minute cilia, without external eyes, and inhabiting caves so similar in structure to the Mammoth Cave, make a comparison of them with the fishes of the Mammoth Cave most interesting. This is greatly enhanced by the fact that the Cuban fishes belong to a family of essentially marine habit, quite far removed from Amblyopsis. The fresh water ling (Lota), belonging to the same great group of fishes (though to a distinct family or subfamily) containing the cod on the one hand and the Cuban blind fish on the other, is probably the nearest fresh water relative of the Cuban fish, but the nearest representative yet known is the marine genus Brotula. one species of which is found in the Caribbean Sea.

In the Cuban blind fish we find ciliary appendages on the head and body quite distinctly developed, evidently of the same character as those of Amblyopsis and answering the purpose of tactile organs. These cilia are in the form of small, but plainly visible, protuberances (reminding one of the single fleshy protuberance over the opercular opening just back of the head in Amblyopsis). There are eight of these on top of the head of a specimen I hastily examined, received from Prof. Poey by the Museum of Comparative Zoology, and quite a number arranged in three rows on each side of the body, showing that tactile sense is well developed in this fish; though it is rather singular that the barbels on the jaws, so usually developed as organs of touch in the cod family and its allies, are entirely wanting in this fish.

The brain of *Lucifuga subterraneus*, as represented by the figures of Poey, differs very much from that of *L. dentatus* and of Amblyopsis. In all, the optic lobes are as largely developed as in allied fishes provided with well developed eyes. In *Lucifuga subterraneus* the cerebral lobes are separated by quite a space from the

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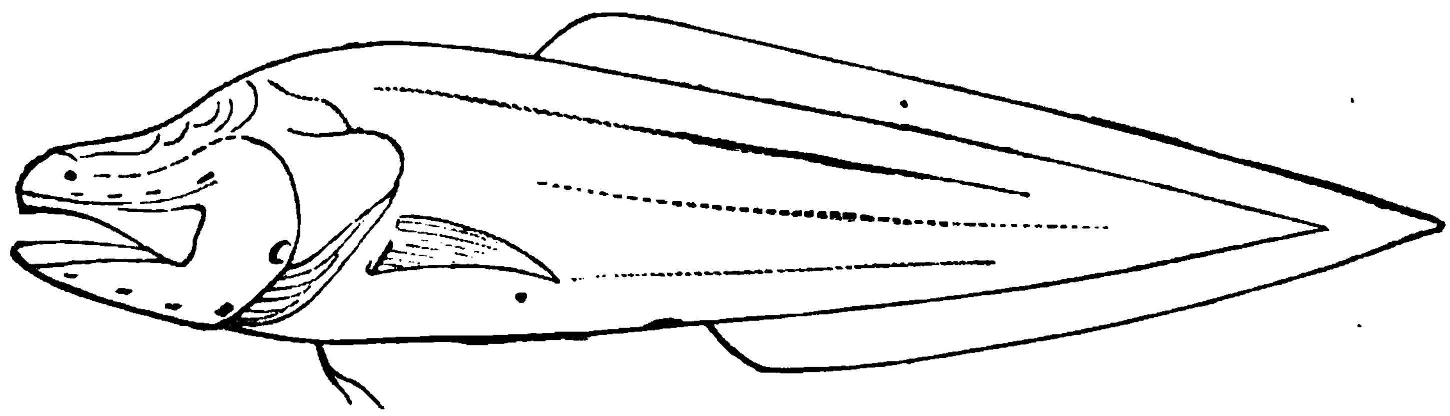
*Memorias Sobre la Historia Natural de la Isla de Cuba, por Felipe Poey. Tomo 2, pp. 95–114. Pls. 9, 10. 11. Habana, 1856–8.

†This species was afterwards referred to the genus *Stygicola* Gill, on account of the presence of palatine teeth which are wanting in the other species. There are also several other good characters, to judge from the figures of the head, skull and brain given by Poey, that would warrant the reference of the fish to a distinct genus from *L. subterraneus*.

round optic lobes, which are represented as a little larger than the cerebral lobes, and also of greater diameter than the cerebellum; this latter being more developed laterally than in either *L. dentatus* or in Amblyopsis. The three divisions of the brain are represented, from a top view, as nearly complete circles (without division into right and left lobes), of which that representing the optic lobes is slightly the largest. In *L. dentatus* the procencephalon and the optic lobes are represented as divided into right and left lobes, as in Amblyopsis, and the cerebellum does not extend laterally over the medulla oblongata as in *L. subterraneus*, but, as in Amblyopsis (Pl. 1, fig. 1 *d*), is not so broad as the medulla, and, projecting forwards, covers a much larger portion of the optic lobes than is the case in *L. subterraneus*.

The Cuban blind fish has the body, cheeks and opercular bones covered with scales. As in Amblyopsis the eyes exist, but are so

Fig. 1.



Blind Fish (*Stygicola dentatus*) from Caves in Cuba.

imbedded in the flesh of the head as to be of no use. The outline cut here given (Fig. 1), copied from Poey, is very characteristic of the form of the fish, but does not exhibit the fleshy cilia or details of scaling.

The first notice that I can find of the Mammoth Cave blind fish is that contained in the "Proceedings of the Academy of Natural Sciences of Philadelphia," Vol. 1, page 175, where is recorded the presentation of a specimen to the Academy by W. T. Craige, M. D., at the Meeting held on May 24, 1842, in the following words:—

> "A white, eyeless crayfish (*Astacus Bartoni?*) and a small white fish, also eyeless (presumed to belong to a subgenus of Silurus), both taken from a small stream called the 'River Styx' in the Mammoth Cave, Kentucky, about two and one-half miles from the entrance."

Dr. DeKay in his "Natural History of New York, Fishes," page 187, published in 1842, describes the fish, from a poor specimen in

the Cabinet of the Lyceum of Natural History of New York, under the name of *Amblyopsis** *spelæus*.† DeKay's description is on the whole so characteristic of the fish as to leave no doubt as to the species he had before him, though the statement that it has eight rays supporting the branchiostegal membrane (instead of six), and that the eyes are "large" but under the skin, must have been due to the bad condition of his specimen and to his taking the fatty layer covering the minute eyes for the eyes themselves, as pointed out by Prof. Wyman. Dr. DeKay places the genus with the Siluridæ (cat fishes) but at the same time questions its connection with the family and says that it will probably form the type of a new family. In 1843 Prof. Jeffries Wyman‡ gave an account of the dissection of a specimen in which he could not find a trace of the eye or of the optic nerve, probably owing to the condition of the specimen, as he afterwards§ found the eye spots, and made out the structure of the eye. When describing the brain, Prof. Wyman calls attention to the fact of the optic lobes being as well developed as in allied fishes with well developed eyes, and asks if this fact does not indicate that the optic lobes are the seat of other functions as well as that of sight. He also calls attention to the papillæ on the head as tactile organs furnished with nerves from the fifth pair.

Dr. Theo. Tellkampf‖ was the first to point out the existence of the rudimentary eyes from dissections made by himself and Prof. J. Müller, and to state that they can be detected in some specimens as black spots under the skin by means of a powerful lens. Prof. Wyman afterwards detected the eye through the skin in several specimens. Dr. Tellkampf also was the first to call attention to the "folds on the head, as undoubtedly serving as organs of touch, as numerous fine nerves lead from the trigeminal nerve to them and to the skin of the head generally."

It is also to Dr. Tellkampf that we are indebted for the first figure of the fish,¶ and for figures illustrating the brain, and internal organs. The descriptions of the anatomy of the fish by Drs.

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*Obtuse vision. †Of a cave.

‡Silliman's Journal, Vol. 45, p. 94.

§Proceedings Boston Soc. Nat. Hist., Vol. 4, p. 395. 1853.

‖Müller's Archiv. fur Anat., 1844. p. 392. Reprinted in the New York Journal of Medicine for July, 1845. p. 84, with plate.

¶The only other figures of the species, that I am aware of, are the simple outlines given in Poey's Mem. de Cuba, the woodcut in Wood's Illustrated Natural History and the cut in Tenney's Zoology. None of these figures are very satisfactory.

Tellkampf and Wyman are all that have ever been written on the subject of any importance, with the exception of the description of the eye by Dr. Dalton, whose paper, in the "New York Medical Times," Vol. 2, p. 354, I have not seen. Prof. Poey gives a comparison of portions of the structure with that of the Cuban blind fishes.

Dr. Tellkampf proposed the name of *Heteropygii** for the family of which, at the time, a single species from the Mammoth Cave was the only known representative, and makes a comparison of the characters with those of *Aphredoderus Sayanus*, a fish found only in the fresh waters of the United States, and belonging to the old family of Percoids, but now considered as representing a family by itself, though closely allied to the North American breams (Pomotis), and having the anal opening under the throat as in the blind fish.

Dr. Storer,† not knowing of Dr. Tellkampf's paper, proposed the name of *Hypsæidæ*, for the blind fish, and placed it between the minnow and the pickerel families, in the order of Malacopterygian, or soft rayed, fishes. According to the system adopted by Dr. Günther, it stands as closely allied to the minnows, *Cyprinodontidæ* (many of which are viviparous and have the single ovary and general character of the blind fish), and the shiners, *Cyprinidæ*, of the order of Physostomi. Dr. Tellkampf, in discussing the relations of the family, points out its many resemblances to the family of Clupesoces, and its differences from the Siluroids, Cyprinodontes and Clupeoids, with which it has more or less affinity, real or supposed. Prof. Cope in his paper on the Classification of Fishes‡ places the Amblyopsis in the order of Haplomi with the shore minnows, pickerel and mud fish, and in an article on the Wyandotte Cave,§ he says that the Cyprinodontes (shore minnows) are its nearest allies. This arrangement by Prof. Cope places the Haplomi between the order containing the herrings and that containing the electric eel of South America, all included with the garpike, dog fish of the fresh waters (Amia), cat fishes, suckers and eels proper, etc., etc., in the division of Physostomi as limited by him.

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*From the advanced position of the terminus of the intestine being so different from the position which it has in ordinary fishes.

† Synopsis of the Fishes of North America, published in 1846.

‡ American Naturalist, Vol. 5, p. 579, 1871.

§ Indianapolis Daily Journal of September 5, 1871. Reprinted in Ann. Mag. Nat. Hist., Nov., 1871.

Prof. Agassiz in 1851 * stated that the blind fish was an aberrant form of the Cyprinodontes.

Thus all those authors who have expressed an opinion as to the position which the fish should hold in the natural system have come to the same conclusions as to the great group, division, or order, into which it should be placed. For all the terms used above, when reduced to any one system, bring Amblyopsis into the same general position in the system; its nearest allies being the minnows, pickerels, shiners and herrings; and unless a careful study of its skeleton should prove to the contrary, we must, from present data, consider the family containing Amblyopsis as more nearly allied to the Cyprinodontes, or our common minnows having teeth on the jaws, than to any other family, differing from them principally by the structure of the several parts of the alimentary canal and the forward position of its termination.

I have thus far mentioned only one species of blind fish from the cave, the *Amblyopsis spelœus.* The waters of the cave not only contain another species of blind fish, differing from Amblyopsis in several particulars, especially by its smaller size and by being without ventral fins, which I have identified as the *Typhlichthys subterraneus* of Dr. Girard; but also a fish with well developed eyes, as proved by the account given by Dr. Tellkampf and by the drawing of a fish found by Prof. Wyman, in 1856, in the stomach of an Amblyopsis he was dissecting. In order to call attention to the fact that fishes with eyes are at times, if not always, in the waters of the cave, I have reproduced the drawing by Prof. Wyman on plate 1, fig. 13. It is very much to be regretted that the specimen is not now to be found, and that it was so much acted on by the gastric juice as to destroy all external characters by which it could be identified from the drawing, which is of about natural size. Dr. Tellkampf's remarks on the fish with eyes are as follows: —

"Besides the colorless blind-fish, there are also others found in the cave, which are black, commonly known by the name of 'mud-fish.' I saw a dark-colored fish in the water, but did not succeed in catching it. The latter are said to have eyes, and are entirely dissimilar to the blind-fish."

The name "mud-fish," given to this fish with eyes, and the statement that it is of a dark color, together with the drawing by Prof.

* Silliman's Journal. p. 128.

Wyman of the fish found in the stomach of the blind fish, showing the position of the dorsal fin to be the same as in the fish commonly called mud fish in the fresh waters of the Middle, Western and Southern States, perhaps, indicates the fish with eyes to be a species of *Melanura*.* This fish is called mud fish from the habit it has of burying itself in the mud, tail first,† to the depth of two to four inches, and of remaining buried in the mud in our western ditches during a time of drought. This habit, perhaps, in a measure fits it for a subterranean life. The occurrence of a fish belonging to the same family with the blind fish, but with well developed eyes, in the subterranean streams in Alabama, as mentioned further on and figured on Pl. 2, fig. 4, however, renders it probable that the cave fish with eyes may be the same or an allied species, and the drawing by Prof. Wyman would answer equally as well for it.

The fact that the Amblyopsis succeeded in catching a fish of, probably, very rapid and darting movements, shows that the tactile sense is well developed and that the blind fish must be very active in the pursuit of its prey; probably guided by the movement which the latter makes in the water so sensibly influencing the delicate tactile organs of the blind fish that it is enabled to follow rapidly, while the pursued, not having the sense of touch so fully developed, is constantly encountering obstacles in the darkness.

In describing the habits of the blind fish Dr. Tellkampf says:—

"It is found solitary, and is very difficult to be caught, since it requires the greatest caution to bring the net beneath them without driving them away. At the slightest motion of the water they dart off a short distance and usually stop. Then is the time to follow them rapidly with a net and lift them out of water. They are mostly found near stones or rocks which lie upon the bottom, but seldom near the surface of the water."

Prof. Cope, in describing the habits of the blind fish which he

* Dr Günther considers the genus Melanura of this country to be synonymous with Umbla of Europe. In each country only one species has been as yet satisfactorily described.

Fig. 2.

Mud fish (*Melanura limi*).

† See the interesting notes on the habits of the mud minnow, by Dr. Abbott in American Naturalist, Vol. 4, pages 107 and 388, with figure of the fish on page 385, which we here reproduce for comparison.

obtained in a stream that passes into the Wyandotte Cave, though he entered it by means of a well in the vicinity of the cave, says that:—

"If these Amblyopses be not alarmed they come to the surface to feed, and swim in full sight like white aquatic ghosts. They are then easily taken by the hand or net, if perfect silence be preserved, for they are unconscious of the presence of an enemy except through the sense of hearing. This sense is, however, evidently very acute, for at any noise they turn suddenly downward, and hide beneath stones, etc., on the bottom. They must take much of their food near the surface, as the life of the depths is apparently very sparse. This habit is rendered easy by the structure of the fish, for the mouth is directed upwards, and the head is very flat above, thus allowing the mouth to be at the surface."

The blind fish has a single ovary, in common with several genera of viviparous Cyprinodontes. In three female specimens of Amblyopsis which I have opened, the ovary was distended with large eggs, but no signs of the embryo could be traced. In these three specimens it was the right ovary that was developed, and this, as in the figure (Plate 2, fig. 1c), was by the side of the stomach and did not extend beyond it. The number of eggs contained in the ovary was not far from one hundred in the specimen figured. As the embryos develop, the mass probably pushes further back in the cavity and also extends the abdominal walls. That the fish is viviparous is proved by the statement made by Mr. Thompson before the Belfast Natural History Society,* that one of the blind fishes from the cave, four and a half inches long, "was put in water as soon as captured, where it gave birth to nearly twenty young, which swam about for some time, but soon died. These, with the exception of one or two, were carefully preserved, and fifteen of them are now before us [at the meeting, I wish they were here], they were each four lines in length."

It is singular that no mention is made regarding these young, as to the presence or absence of eyes, and, as if it was fated that this important point should remain unnoticed as long as possible, it is equally singular that Dr. Steindachner omitted to examine some very young specimens which he received from a friend a few months since and sent to the Vienna Museum, where they will remain unexamined until he returns there. I saw the Doctor only

* Annals and Mag. of Natural History, Vol. xiii, pp. 112, 1844.

a week after these, to me, interesting specimens had been sent abroad, and he was as grieved as I was disappointed at my being just too late to take advantage of them.

At what time the young are born has never been stated, but judging from such data as I can at present command, I think that it must be during the months of September and October. Specimens collected during those months would probably contain embryos in various stages of development, the examination of which would undoubtedly lead to most interesting results.

Prof. Wyman has most generously placed in my hands his unpublished notes and drawings of the several dissections he has made of Amblyopsis, as well as his specimens and dissections. Many of these drawings are reproduced on Plate 1, and will, with his notes which I here give, greatly enhance the value of this article, as his dissections have been made with the utmost care, and with a patience and delicacy that only a master hand attains. It will therefore be understood that, in giving credit to Prof. Wyman in the following pages, I refer to his unpublished notes, except when the quotation is given from a special work. In quoting his description of the eye and ear from "Silliman's Journal" I have changed the references so as to refer to his drawings reproduced on Plate 1, and not to the three cuts given in "Silliman's Journal," though the figures of the brain and of the otolite were copied from those cuts.

The largest specimens I have seen of Amblyopsis are several males and females, each from four to four and a half inches in length, which seems to be about as large as the fish grows, though Dr. Günther mentions a specimen in the British Museum of five inches in length. The largest specimen captured of late years is said to have been taken, during the summer of 1871, and sold for ten dollars to a person who was so desirous of securing the precious morsel that he had it cooked for his supper. The smallest specimen I have seen was one and nine-tenths inches in length. The general shape and character of the fish is best shown by the figures on plates 1 and 2.

"The whole head, above and below, is destitute of scales, the naked skin extending backwards on the sides to the base of the pectoral fins; the scaly portion of the body above ends in a semicircular edge covering the space between the upper ends of the opercula. The skin covering the middle region of the head is

smooth, but on either side is provided with numerous transverse and longitudinal ridges (Pl. 1, fig. 7), which are, on the whole, regularly arranged. The first row of transverse ridges, eight or nine in number, begins between the nostrils and extends backwards, diverging from the median line. The third ridge is crossed at its outer end by a longitudinal one, as are also two others farther back. The second and third rows, situated, in part, on the sides and, in part, on the under surface, are less regular than the preceding. A fourth, on the borders of the operculum, is still less well defined. The transverse are also crossed here by longitudinal ridges. About ten vertical ridges, also provided with papillæ, and similar to those on the head, are visible on the sides extending from the pectoral fins to the tail, but are not so well defined as those on the head. The skin of the head is of extreme delicacy and is covered by a very thin, loose layer of epithelium."—WYMAN.

"The larger ridges have between twenty and thirty papillæ, many of these having a cup-shaped indentation at the top, in which a delicate filament is, in some instances, seen (Pl. 1, fig. 9). These papillæ are largely provided with nervous filaments, and, as is obvious from their connection with branches of the fifth pair of nerves, must be considered purely tactile, and the large number of them shows that tactile sensibility is probably very acute and in some measure compensates for the virtual absence of the sense of sight. Plate 1, fig. 8, represents one of the ridges of the head magnified, showing the papillæ of which it is made up, and figure 9 shows three papillæ still more enlarged. Two of these show a cup-shaped cavity at the top, and the short, slender filament already mentioned. The surface of the papillæ is covered with loosely connected epithelium cells. Fig. 10 shows the nervous filaments distributed to the papillæ: *a*, a branch of the fifth pair of nerves passing beneath the papillary ridge and sending filaments to each papilla. These papillary branches interchange filaments, forming a nervous plexus in connection with each ridge. This figure of the nerves was drawn with a camera lucida, from a specimen treated with acetic acid."—WYMAN.

"Plate 1, fig. 6, represents a double system of subcutaneous canals, which extend the whole length of the head, but were not traced farther back than the edge of the naked or scaleless skin which covers it. Forwards they bifurcate, nearly encircling the nasal cavity, towards the middle line ending in a blind pouch.

The lateral branch was not traced distinctly to an end, but seemed to connect with the olfactory cavity. The walls of these canals are exceedingly delicate and easily overlooked." — WYMAN.

"Plate 1, fig. 5, shows the globe of the eye with the optic nerve (*c*), as seen under the microscope. The lens (*b*) is detached from its proper place by the pressure of the glass. Irregularly arranged muscular bands are attached to the exterior of the globe (*a*, *a*, *a*, *a*), but were not recognized as the homologues of the muscles of the normal eye of fishes; nevertheless, they indicate that the globe was moveable." — WYMAN.

"In the three specimens recently dissected, the eyes were exposed only after the removal of the skin, and the careful separation from them of the loose areolar tissue which fills the orbit. In a fish four inches in length the eyes measured one-sixteenth of an inch in their long diameter, and were of an oval form and black. A filament of nerve (Pl. 1, fig. 3*a*) was distinctly traced from the globe to the cranial walls, but the condition of the contents of the cranium, from the effects of the alcohol, was such as to render it impracticable to ascertain the mode of connection of the optic nerve with the optic lobes.

Examined under the microscope with a power of about twenty diameters, the following parts were satisfactorily made out (Pl. 1, fig. 3): 1st, externally an exceedingly thin membrane, *b*, which invested the whole surface of the eye and appeared to be continuous with a thin membrane covering the optic nerve, and was therefore regarded as a sclerotic; 2d, a layer of pigment cells, *d*, for the most part of a hexagonal form, and which were most abundant about the anterior part of the eye; 3d, beneath the pigment a single layer of colorless cells, *c*, larger than a pigment cell, and each cell having a distinct nucleus; 4th, just in front of the globe, a lenticular-shaped, transparent body, *e* [see also fig. 4], which consisted of an external membrane containing numerous cells with nuclei. This lens-shaped body seemed to be retained in its place by a prolongation forwards of the external membrane of the globe; 5th, the globe was invested by loose areolar tissue, which adhered to it very generally, and in some instances contained yellow fatty matter; in one specimen it formed a round spot, visible through the skin on each side of the head, which had all the appearance of a small eye; its true nature was determined by the microscope only. It is not improbable that the appearance just referred to may have misled Dr. DeKay — where he states that the eye exists of the usual size, but covered by the skin.

If the superficial membrane above noticed is denominated correctly the *sclerotic*, then the pigment layer may be regarded as the representation of the *choroid*. The form as well as the position of the transparent nucleated cells within the choroid correspond

for the most part with the *retina*. All of the parts just enumerated are such as are ordinarily developed from and in connection with the encephalon, and are not in any way dependent upon the skin. But if the lenticular-shaped body is the true representative of the crystalline lens, it becomes difficult to account for its presence in Amblyopsis according to the generally recognized mode of its development (since it is usually formed from an involution of the skin) unless we suppose that after the folding in of the skin had taken place in the embryonic condition, the lens retreated from the surface, and all connection with the integument ceased.[*]

According to Quatrefages, however, the eye of Amphioxus [†] is contained wholly in the cavity of the dura mater, and yet it has all the appearance of being provided with a lens. If his description be correct, then the mode of development as well as the morphology of the eye in this remarkable fish is different from that of most other vertebrates, since the lens never could have been formed from an involution of the skin, nor could the eye with its lens, as Prof. Owen asserts, be a modified cutaneous follicle. Whatever views be taken with regard to the development of the eye of the blind fish, the anatomical characters which have been enumerated show, that though quite imperfect as we see it in the adult, it is constructed after the type of the eyes of other vertebrates. It certainly is not adapted to the formation of images, since the common integument and the areolar tissue which are interposed between it and the surface, would prevent the transmission of light to it except in a diffused condition. No pupil or anything analogous to an iris was detected, unless we regard as representing the latter the increased number of pigment cells at the anterior part of the globe.

It is said that the blind fishes are acutely sensitive to sounds as well as to undulations produced by other causes in the water. In the only instance in which I have dissected the organ of hearing (which I believe has not before been noticed), all its parts were largely developed, as will be seen by reference to Pl. 1, fig. 1 *e*. As regards the general structure, the parts do not differ materially from those of other fishes except in their proportional dimensions. The semi-circular canals are of great length, and the two which unite to enter the vestibule by a common duct, it will be seen, project upwards and inwards under the vault of the cranium, so as to approach quite near to the corresponding parts of the opposite side. The otolite contained in the utricle was not remarkable, but that of the vestibule (Pl. 1, fig. 2) and seen in

* In birds and mammals there is a stage of development where the lids come together and firmly unite, to separate again when the animal "gets his eyes open." In the mole rat (*Spalax typhlus*) of Siberia, the lids never open, and the eyes remain through life covered with hairy skin. It is not improbable that in Amblyopsis something analogous to this, a closing of the skin over the eye, may have taken place.—J. W.

† I have used the prior name of *Branchiostoma* in this paper when speaking of the Lancelet.

dotted outline in fig. 1 *e* is quite large when compared with that of a Leuciscus of about the same dimensions as the blind-fish here described."—WYMAN, *Silliman's Journal*, *Vol.* 17, *p.* 259, 1854.

The *Amblyopsis spelæus* undoubtedly has quite an extensive distribution, probably existing in all the subterranean rivers that flow through the great limestone region underlying the Carboniferous rocks in the central portion of the United States. Prof. Cope obtained specimens from the Wyandotte Cave and from wells in its vicinity, and in the Museum of Comparative Zoology at Cambridge there is a specimen labelled "from a well near Lost River, Orange Co., Ind.," which, with those from the Wyandotte Cave, is conclusive evidence of its being found on the northern side of the Ohio* as well as on the southern, in the rivers of the Mammoth Cave. I have been able to examine a number of specimens from the Mammoth Cave, and have carefully compared with them the one from the well in Orange Co., Ind., and find that the specific characters are remarkably constant.

In 1859† Dr. Girard described a blind fish, received by the Smithsonian Institution from J. E. Younglove, Esq., who obtained it "from a well near Bowling Green, Ky." The general appearance of this fish, which was only one and a half inches in length, was that of *Amblyopsis spelæus*, but it differed from that species in several characters, especially by the *absence* of ventral fins. Dr. Girard therefore referred the fish to a distinct genus under the name of *Typhlichthys*‡ *subterraneus*. Dr. Günther § considers this fish a variety of *Amblyopsis spelæus* and records the specimen in the British Museum "from the Mammoth Cave," as "half-grown." ‖

By the kindness of Prof. Agassiz, I have been enabled to examine nine specimens of *blind fish without ventrals*, in the Museum of Comparative Zoology. Seven of these were collected in the Mammoth Cave by Mr. Alpheus Hyatt in September, 1859. One was from Moulton, Lawrence County, Alabama, presented by Mr. Thomas Peters; and another from Lebanon, Wilson Co., Tennessee; presented by Mr. J. M. Safford. It is not stated whether

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* I have also been informed by Mr. Holmes of Lansing, Mich., that *blind fishes* have been drawn out of wells in Michigan.

† Proceedings Acad. Nat. Sci. Philad., p. 63.

‡ Blind fish.

§ Catalogue of Fishes in the British Museum, Vol. 7, p. 2, 1868.

‖ The largest specimen I have seen of Typhlichthys is one and seventeen-twentieths inches in length, and the smallest Amblyopsis one and eighteen-twentieths inches.

these latter came from wells or caves, but probably from wells. They are all of about the same size, one and one-half to two inches in length, and are constant in their characters. Moreover, four of the seven specimens from the Mammoth Cave were females with eggs. These eggs were as large in proportion as those from Amblyopsis. The ovary was single and situated on the right side of the stomach, as in Amblyopsis. The difference in the number of eggs was very remarkable, each of the four specimens examined having but about thirty eggs in the ovary, while in three females of Amblyopsis (all, however, of nearly three times the size of Typhlichthys) there were about one hundred eggs in each. As in both species there were no signs of the embryos in the eggs, it is not probable that any of the eggs had been developed and the young excluded, nor is it at all likely that the great variation in the number of eggs would simply indicate different ages. By a reference to the figures (Pl. 2), it will be seen that the pyloric appendages, stomach and scales of the two fishes are different. For these reasons, taken in connection with the absence of ventral fins, I have no hesitation in accepting Dr. Girard's name as valid for this genus, of which we thus far know of but one species, with a subterranean range from the waters of the Mammoth Cave, south to the northern portion of Alabama. In this connection it would be most interesting to know the relations of the "blind fishes" said to have been found in Michigan. For thus far we have Typhlichthys limited to the central and southern portion of the subterranean region, Amblyopsis to the central, and the species in the northern portion undetermined.

In 1853, on his return from a tour through the southern and western states, Prof. Agassiz gave a summary of some of his ichthyological discoveries in a letter to Prof. J. D. Dana.* In this letter are the following remarks:—

"I would mention foremost a new genus which I shall call *Chologaster*, very similar in general appearance to the blind fish of the Mammoth Cave, though provided with eyes; it has, like Amblyopsis, the anal aperture far advanced under the throat, but is entirely deprived of ventral fins; a very strange and unexpected combination of characters. I know but one species, *Ch. cornutus* Ag. It is a small fish scarcely three inches long, living in the ditches of the rice fields in South Carolina. I derive its specific

* Published in American Journal of Sci. and Arts, Vol. 16 (2d series), p. 134, 1853.

name from the singular form of the snout, which has two horn-like projections above."

This is the only information ever published regarding this interesting fish and the only specimens known are those on which Prof. Agassiz based the above remarks.

By the kindness of Professor L. Agassiz, who has placed all the specimens of the family contained in the Museum of Comparative Zoology in my hands for study, I am enabled to give a figure and description of this interesting species from the three specimens in the Museum, which were labelled as the originals of *Chologaster cornutus* Ag., from Waccamaw, S. C., presented by Mr. P. C. J. Weston, 1853. The largest of these specimens was distended with eggs and I was enabled to compare the ovary with that of Amblyopsis. From its being single and the eggs very large, I have no doubt that it is a viviparous fish like the other genera of the family. The position of the ovary behind the stomach, as shown in fig. 2*c*, plate 2, and the presence of four pyloric appendages (Pl. 2, fig. 2*a*) instead of two, as in Amblyopsis (fig. 1*a*) and Typhlichthys (fig. 3*a*), are good internal characters, separating it from the other genera, independently of the presence of eyes and the absence of ventral fins and papillary ridges.

The stability of the internal characters I have mentioned was most unexpectedly substantiated by the discovery of a second species (Pl. 2, figs. 4, 4*a*) of the genus among the specimens in the Museum of Comparative Zoology. I have the pleasure of dedicating this species* to Professor Agassiz, not only in kindly remembrance of the eight years I was associated with him as student and assistant, but also because the fish so well illustrates the decided position he has taken relative to the immutability of species.

The only specimen known of this second species was drawn from a well in Lebanon, Tenn., and presented to the Museum by Mr. J. M. Safford, Jan., 1854. It is a more slender fish than *C. cornutus*, but the intestine follows the same course and the four pyloric appendages are present as in that species.

In the genus Chologaster† we have all the family characters as well expressed as in the blind species, though it differs from Am-

* A Synopsis of this family with descriptions of the four species will appear in the "Report of the Peabody Academy of Science for 1871."

† Literally "bile-stomach;" probably named from the yellow color of the fish.

blyopsis and Typhlichthys by the presence of eyes, the absence of papillary ridges on the head and body, and by the longer intestine and double the number of pyloric appendages, as well as by the position of the ovary; and agrees with Typhlichthys by the absence of ventral fins. Amblyopsis and Typhlichthys are nearly colorless, while *Chologaster Agassizii* is of a brownish color similar to many of the minnows, and *C. cornutus* is brownish yellow, with dark, longitudinal bands.

Among the most interesting points in the history of this genus is the fact of its occurring in two widely different localities, *C. Agassizii* having been found in a well, in the same vicinity (probably in the same well) with a specimen of Typhlichthys, and undoubtedly belonging to the same subterranean fauna west of the Appalachian ridge, while *C. cornutus* belongs to the southern coast fauna of the eastern side of that mountain chain, and is thus far the only species of the family known beyond the limits of the great subterranean region of the United States.

Having now given an outline of the structure, habits and distribution of the four species belonging to the family, and recapitulated the known facts, we are better able to consider the bearings of the peculiar adaptation of the blind fishes, in the Mammoth and other caves, to the circumstances under which they exist.

Prof. Cope in stating, in his account of the blind fish of the Wyandotte Cave, "that the projecting under jaw and upward direction of the mouth renders it easy for the fish to feed at the surface of the water, where it must obtain much of its food," suggests that: —

"This structure also probably explains the fact of its being the sole representative of the fishes in subterranean waters. No doubt many other forms were carried into the caverns since the waters first found their way there, but most of them were like those of our present rivers, deep water or bottom feeders. Such fishes would starve in a cave river, where much of the food is carried to them on the surface of the stream. . . . . . The shore minnows are their nearest allies, and many of them have the upturned mouth and flat head. . . . . . Fishes of this, or a similar family, enclosed in subterranean waters ages ago, would be more likely to live than those of the other, and the darkness would be very apt to be the cause of the atrophy of the organs of sight seen in the Amblyopsis."

This suggestion was undoubtedly hastily made by Prof. Cope when writing the letter which was printed in the "Indianapolis

Journal," and were it not that the article has been reprinted in the "Annals and Magazine of Natural History," I should not criticise the statement made in an off-hand letter for publication in a newspaper; for with Prof. Cope's knowledge of fishes it could simply be a hasty thought which he put on paper, when he suggests that it is because the Cyprinodontes have a mouth directed upwards and are surface feeders that they were better adapted to a subterranean life than other fishes, and hence maintained an existence, while other species, which he supposes were introduced into the subterranean streams at the same time, died out.

If the fishes of the subterranean streams came from adjoining rivers, why were not many of the Percoids, Cyprinoids and other forms, that are as essentially surface feeders as the Cyprinodontes (many of the latter are purely "mud feeders"), as capable of maintaining an existence in the subterranean waters as any species of the latter? Neither is it necessary for us to assume that the structure of the fish should be adapted to feeding on the surface, for not only have we in the blind cat fish, described by Prof. Cope himself, from the subterranean stream in Pennsylvania, an example of a fish belonging to an entirely different family of bottom feeders, thriving under subterranean conditions, but the blind fishes of the Cuban caves are of the great group of cod fishes which are, with hardly an exception, bottom feeders. The fact that the food of the blind fishes of the Mammoth Cave consists in great part of the cray fish found in the waters of the cave, as shown by the contents of several stomachs I have examined, and also that one blind fish at least made a good meal of another fish, as already mentioned, shows that they are not content with simply waiting for what is brought to them on the surface of the water, and that they are probably as much bottom as surface feeders.

Again, in regard to the sense of sight, why is it necessary to assume that because fishes are living in streams where there is little or no light, that it is the cause of the non development of the eye and the development of other parts and organs? If this be the cause, how is it that the Chologaster from the well in Tennessee, or the "mud fish" of the Mammoth Cave are found with eyes? Why should not the same cause make them blind if it made the Amblyopsis and Typhlichthys blind? Is not the fact, pointed out by Prof. Wyman, that the optic lobes are as well developed in Amblyopsis as in allied fishes with perfect eyes, and, I may add,

as well developed as those of *Chologaster cornutus*, an argument in favor of the theory that the fishes were always blind and that they have not become so from the circumstances under which they exist? If the latter were the case and the fishes have become blind from the want of use of the eyes, why are not the optic lobes also atrophied, as is known to be the case when other animals lose their sight? I know that many will answer at once that Amblyopsis and Typhlichthys have gone on further in the development and retardation of the characters best adapting them to their subterranean life, and that Chologaster is a very interesting transitionary form between the open water Cyprinodontes and the subterranean blind fishes. But is not this assumption answered by the fact that Chologaster has every character necessary to place it in the same family with Amblyopsis and Typhlichthys, while it is as distinctly and widely removed from the Cyprinodontes as are the two blind genera mentioned?

Assuming, for the moment, that Chologaster is a transitional form between the surface feeding Cyprinodontes, and Typhlichthys and Amblyopsis, let us recapitulate the characters that distinguish the different forms and see if they exhibit transitions, and if Chologaster is traversing the slow developmental road to Amblyopsis.

Allowing all characters embraced in the general structure of the skeleton, brain, scales, fins, etc., as ordinal, and common to both Cyprinodontes and Heteropygii, we will recapitulate only such as can be considered of family and generic value in the two groups.

	CYPRINODONTES.	CHOLOGASTER.	TYPHLICHTHYS.	AMBLYOPSIS.
Surface feeders.	In part.	Unknown.	Partially.	The same.
Intestine.	In many genera long and convoluted, in others short and with single turn.	Moderately long with two turns.	Shorter with two turns.	The same.
Stomach & pyloric appendages.	In most, if not all, stomach not well defined from intestine and without appendages.	Stomach well defined, cœcal, with two pyloric appendages on each side.	The same, with one pyloric appendage on each side.	The same.
Viviparous.	Many genera.	Probably.	Probably.	Undoubtedly.
Ovary.	Single in viviparous genera* and placed by the side of intestine in some and posterior in others.	Single and placed behind the stomach.	Single and placed at side of stomach.	The same.

* The ovary is also single in other genera of viviparous fishes belonging to distinct orders.

Anal opening.	In normal position.	Forward of pectorals.†	The same.	The same.
Air bladder.	Present in few genera.‡	Present.	The same.	The same.
Scales.	On body regularly imbricated and loosely attached.	Irregularly arranged, firmly attached by being covered in great part by the cuticle.	The same.	The same.
Head with scales or naked.§	With scales.	Naked.	The same.	The same.
Tactile papillæ‖ *on the head and body.*	Absent.	Absent.	Very prominent as ridges on the head and sides of body.	The same.
Ventral fins.¶	Present in most genera, absent in at least two.	Absent.	Absent.	Present.
*Eyes.***	Well developed in all.	Well developed and normal.	Rudimentary†† and of no use.	The same.
Habitat.	Fresh water; brackish water; salt water.	Limestone water of subterranean rivers. Brackish water?	Limestone water of subterranean rivers.	The same.
Geographical range.	Nearly all parts of the world.	One species in subterranean streams of S. central portion of the U. S.; a 2d species in the So. Atl. coast fauna of U. S.	Central & southern portion of subterranean fauna of United States.	Central and N. central portion of same.

From this brief comparison of some of the prominent characters of the genera of the Heteropygii with the Cyprinodontes, their

† Aphredoderus and Gymnotus, and other genera of distinct orders have this forward position of the anus also.

‡ The air bladder is in several families present in some species and absent in others.

§ The presence or absence of scales on the head, or on portions of it, is a generic character subject to great variation in many families and quite constant in others.

‖ I cannot recall anything but the barbels on the head and jaws of many genera, of Cyprinoids, Siluroids, Gadoids, etc., etc., that can be said to be tactile organs, among fishes, with the exception of the fleshy papillæ on the head and body of the blind fishes of the American and Cuban caves, and the filaments of the fin rays of many fishes and the fleshy ventral rays of the Gurnards.

¶ Of all fins, the ventrals are the most likely to deviate from their normal structure and position. Their presence or absence, as exhibited in many families, and often by different ages of the same fish, and the great variation in their position in different genera of the same family, render any change in them of either generic, specific, or individual character, or simply indicative of age (as they are lost in some adult fishes while present in the young, and in others not developed until after the other fins).

** As I have alluded to the fact, in the first part of this paper, the eyes of fishes are no more the constant and unvarying part of the fish structure than the ventral fins, and like them are subject to almost every conceivable variation in position in the head, and perfection in structure.

†† The largest specimen I have seen of Typhlichthys, is less than two inches in length, and as the eye of an Amblyopsis of twice the size is not over a 32d of an inch in width, it must be very small indeed in Typhlichthys, and I confess to not being able to find it in an ordinary dissection, assisted only by a good lens.

acknowledged nearest allies, we can only trace what could be regarded as a transition, or an acceleration, or a retardation of development, in simply those very characters, of eyes and ventral fins, that are in themselves of the smallest importance in the structure (permanence of character considered) of a fish, and, as if to show that they were of no importance in this connection, we find in the same cave, blind fishes with ventrals and without, and in the same subterranean stream, a blind fish and another species of the family with well developed eyes.

If it is by acceleration and retardation of characters that the Heteropygii have been developed from the Cyprinodontes, we have indeed a most startling and sudden change of the nervous system. In all fishes the fifth pair of nerves send branches to the various parts of the head, but in the blind fishes these branches are developed in a most wonderful manner, while their subdivisions take new courses and are brought *through* the skin, and their free ends become protected by fleshy papillæ, so as to answer, by their delicate sense of touch, for the absence of sight. At the same time the principle of retardation must have been at work and checked the development of the optic nerve and the eye (which probably exists externally in the young fish), while acceleration has caused other portions of the head to grow and cover over the retarded eye.

Now, if this was the mode by which blindness was brought about and tactile sense substituted, why is it that we still have *Chologaster Agassizii* in the same waters, living under the same conditions, but with no signs of any such change in its senses of sight and touch? It may be said that the Chologaster did not change because it probably had a chance to swim in open waters and therefore the eyes were of use and did not become atrophied. We can only answer, that if the Chologaster had a chance for open water, so did the Typhlichthys and yet that is blind.

If the Heteropygii have been developed from Cyprinodontes, how can we account for the whole intestinal canal becoming so singularly modified, and what is there in the difference of food or of life that would bring about the change in the intestine, stomach and pyloric appendages, existing between Chologaster and Typhlichthys in the same waters? To assume, that under the same conditions, one fish will change in all these parts and another remain intact, by the blind action of uncontrolled natural laws, is, to me, an assumption at variation with facts as I understand them.

Looking at the case from the standpoint which the facts force me to take, it seems to me far more in accordance with the laws of nature, as I interpret them, to go back to the time when the region now occupied by the subterranean streams, was a salt and brackish water estuary, inhabited by marine forms, including the brackish water forms of the Cyprinodontes and their allies (but not descendants) the Heteropygii. The families and genera having the characters they now exhibit, but most likely more numerously represented than now, as many probably became exterminated as the salt waters of the basin gradually became brackish and more limited, as the bottom of this basin was gradually elevated, and finally, as the waters became confined to still narrower limits and changed from salt to brackish and from brackish to fresh, only such species would continue as could survive the change, and they were of the minnow type represented by the Heteropygii, and perhaps some other genera of brackish water forms that we have not yet discovered.

In support of this hypothesis we have one species of the family, *Chologaster cornutus*, now living in the ditches of the rice fields of South Carolina, under very similar conditions to those under which others of the family may have lived in long preceding geological times; and to prove that the development of the family was not brought about by the subterranean conditions under which some of the species now live, we have the one with eyes living with the one without, and the South Carolina species to show that a subterranean life is not essential to the development of the singular characters which the family possess.

That a salt or brackish water fish would be most likely to be the kind that would continue to exist in the subterranean streams, is probable from the fact that in all limestone formations caves are quite common, and would in most instances be occupied first with salt water and then brackish, and finally with fresh water so thoroughly impregnated with lime as to render it probable that brackish water species might easily adapt themselves to the change, while a pure fresh water species might not relish the solution of lime any more than the solution of salt, and we know how few fishes there are that can live for even an hour on being changed from fresh to salt, or salt to fresh, water. We have also the case of the Cuban blind fishes belonging to genera with their nearest representative in the family a marine form, and with the

whole family of cods and their allies, to which group they belong, essentially marine. Further than this the cat fish from the subterranean stream in Pennsylvania belongs to a family having many marine and brackish water representatives. As another very interesting fact in favor of the theory that the Heteropygii were formerly of brackish water, we have the important discovery by Prof. Cope of the Lernæan parasite on a specimen of Amblyopsis from the Wyandotte cave; this genus of parasitic crustaceans being very common on marine and migratory fishes, and much less abundant on fresh water species.

Thus I think that we have as good reasons for the belief in the immutability and early origin of the species of the family of Heteropygii, as we have for their mutability and late development, and, to one of my, perhaps, too deeply rooted ideas, a far more satisfactory theory; for, with our present knowledge, it is but theory on either side.

EXPLANATION OF PLATES.

PLATE 1.

[All the figures on this plate are from original drawings by Prof. J. Wyman.]

FIG. 1. Brain, nerves and organ of hearing of *Amblyopsis spelæus*; enlarged; *a*, olfactory lobes and nerves; *b*, cerebral lobes; *c*, optic lobes; *d*, cerebellum; *e*, organ of hearing, showing the semicircular canals, with the otolite represented in place by the dotted lines; *f*, medulla oblongata; *g*, optic nerves and eye specks.

FIG. 2. Otolite, enlarged.

FIG. 3. Eye, magnified (natural size one-sixteenth of an inch in length); *a*, optic nerve; *b*, sclerotic membrane; *c*, layer of colorless cells; *d*, layer of pigment cells (iris ?); *e*, lens.

FIG. 4. Lens, enlarged and showing the cells.

FIG. 5. Eye, enlarged, showing the muscular bands, *a*, *a*, *a*, *a*; *b*, the lens pressed out of place; *c*, the optic nerve.

FIG. 6. Top of head, showing the canals under the skin, of the natural size. The two black dots and lines indicate the eyes and optic nerves in position.

FIG. 7. Top of head, showing the arrangement of the ridges of papillæ. Natural size.

FIG. 8. One of the ridges of papillæ from the head, magnified.

FIG. 9. Three of the papillæ from the ridge, still more magnified, showing the cup-shaped summit and projecting filament.

FIG. 10. A portion of the ridge magnified, and treated with acid, to show the arrangement of the nervous plexus supplying the papillæ with nerve filaments from a branch (*a*) of the fifth pair.

FIG. 11. Epithelial cells from the head.

FIG. 12. Epithelial cells from the body.

FIG. 13. A fish with eyes, found in the stomach of an Amblyopsis.

PLATE 2.

FIG. 1. AMBLYOPSIS SPELÆUS DeKay. Natural size.
1*a*. Stomach and pyloric appendages. Twice natural size.
1*b*. Scale, magnified.
1*c*. Abdominal cavity, showing position of stomach and single ovary. Natural size.

FIG. 2. CHOLOGASTER CORNUTUS Agassiz. Natural size.
2*a*. Stomach and pyloric appendages. Twice natural size.
2*b*. Scale. magnified.
2*c*. Abdominal cavity, showing stomach and single ovary behind the stomach. Twice natural size.

FIG. 3. TYPHLICHTHYS SUBTERRANEUS Girard. Natural size.
3*a*. Stomach and pyloric appendages. Twice natural size
3*b*. Scale, magnified

FIG. 4. CHOLOGASTER AGASSIZII Putnam. Natural size.
4*a*. Stomach and pyloric appendages. Twice natural size.
4*b*. Scale, magnified.

The scales figured on the plate are all from the second or third row under the dorsal fin. 4 *b* is represented with the posterior margin *down*, all the others are represented with the posterior margin on the *left*. The natural size of the scales is given by the minute outline at the left of the figures above each scale; 4 *b* is so small that the natural size can hardly be represented by the black dot.

NOTE TO ARTICLE IN DECEMBER NUMBER, BY A. S. PACKARD, JR.

Since my article was printed, Prof. Cope's article entitled "Life in the Wyandotte Cave" has appeared in the "Annals and Magazine of Natural History" (London) for November. He enumerates the following articulates as inhabitants of this cave; "*Anophthalmus Tellkampfii*, and another species; two species of Staphylinidæ; Raphidophora; two species of flies; an Aranea-like and Opilio-like spider; a species of Pseudotremia; Cambarus pellucidus, an unknown aquatic Crustacean with external egg pouches. and a Lernæan (crustacean) parasitic on the blind fish. Of these one beetle (Anophthalmus), the cricket (Raphidophora), a fly, the Opilio-like spider, the centipede, and the blind crawfish, are probably the same as those found in the Mammoth Cave. Two beetles and two crustaceans are certainly different from those of the latter, and the centipedes are much more numerous. The Gammaroid crustacean found in the waters of the Mammoth Cave, and which is, no doubt in part, the food of the blind fish, we did not find; but some such species no doubt exists, as we found an abundance of a lively little tetradecapod crustacean near the mouth of a cave close by."

A NEW ERECTING ARRANGEMENT, ESPECIALLY DESIGNED FOR USE WITH BINOCULAR MICROSCOPES.

BY R. H. WARD, M.D.

FOR dissecting and other manipulations under magnifying powers, the simple microscope is awkward and unsatisfactory, and has been made to serve as a binocular only with low powers; but the superb field of the compound microscope has been comparatively little used for these purposes because few persons can work to advantage under an inverting arrangement, the erectors usually

furnished are not good, and the use, otherwise satisfactory, of a good objective as an erector has not as yet afforded the advantage of binocular vision. The simple expedient now proposed is designed to increase the usefulness of the stereoscopic binoculars in ordinary use by rendering them easily available for purposes which require an erect image.

Last summer I proposed, at the Indianapolis meeting of the American Association, to place, for certain purposes, an erecting objective below instead of above the regular objective of the microscope. Then, of course, the regular objective becomes the erector, and the accessory one below acts as the objective. This simple expedient, applied to Wenham's or other non-erecting binoculars, leaves little to be desired for the purposes of a dissecting microscope. As a simple contrivance, the lenses of a one-and-a-half or two-inch objective (preferably a solid or single-combination one) may be packed or screwed into the upper end of an adapter which when screwed into the nose-piece of the microscope carries them up close to the binocular prism, and into the lower end of which, lengthened more or less by two or three adapters of various lengths, the object glass may be screwed. A more elegant but scarcely more satisfactory arrangement is an adapter with sliding-tube adjustment which varies to the extent of an inch or more the distance between the erector and objective. Different powers and distances will of course be used according to the wants of different observers. The combination which has proved most convenient in my hands consists of a two-inch erecting lens close to the binocular prism, and a two-thirds objective at a distance, measured to its lowest end, of from three to four and a quarter inches below the erector; giving powers of ten to fifty diameters, and requiring a working distance between the stage and the binocular prism of four and one-half to five inches, which is quite practicable with large stands. A shorter working distance may be gained at a slight disadvantage. With a two-inch erector and four-tenths inch objective, powers of eight to fifty diameters can be secured without removing the binocular prism more than four inches from the stage; and with a one-inch erector and two-thirds inch objective a power of forty diameters is obtained with the binocular prism three and three-fourths inches from the stage. When, however, sufficient working distance cannot be obtained, the object may sometimes be placed upon the substage, or, oftener,

the substage removed and the body racked down so as to focus through the empty stage upon the table, a block or box, or an extemporized stage occupying the usual position of the mirror and illuminated by the mirror after the method suggested by Mr. James Smith. In this case it is desirable to increase the working distance between the prism and the object by varying the lenses employed. Thus a one-and-a-half-inch objective at from three and three-fourths to five and three-fourths inches from the erector will give powers of six to fifty diameters and working distance from prism of seven to ten inches. The erector may also be removed an inch or more from the prism. When this latter arrangement is to be used exclusively, placing the object at from eight to ten or twelve inches from the prism, as in many students' microscopes, the apparatus is further simplified by screwing a two-inch objective into the nose-piece in its usual position, as an erector, and screwing or sliding over it an adapter carrying a-one-and-a-half or two-inch objective from four to six inches lower down Some contrivance is required to illuminate transparent objects under the lower powers; but opake and translucent objects on a black ground can be dissected and manipulated with great facility.

The same erecting arrangement can be used in connection with monocular microscopes that have no draw-tube and therefore cannot use an erector in the usual position. It may also be used as a means of working Wenham's and other binoculars, with high powers. With powers of five hundred or one thousand diameters, however, it is still difficult to obtain good definition or to fully light both fields.

THE RATTLESNAKE AND NATURAL SELECTION.

BY PROF. N. S. SHALER.

For some years I have been teaching that the tail appendage of the rattlesnake was not to be explained on the doctrine of natural selection, inasmuch as it could contribute in no way to the advantage of the animal. It seemed to me quite clear that it was rather calculat d to hinder than to help the creature in the race of life by warning its prey of its presence. Nor did it seem easy to ac-

count for its existence by supposing that it was used as a sexual call and had been brought up by natural or sexual selection for some such office. The burrowing habits of the serpents would seem to make sexual calls almost unnecessary and there is no evidence to make a reasonable basis for belief that rattlesnakes exercise any such choice in pairing as would lead to the development of this very singular appendage. Last summer, however, I had a long desired opportunity of examining a little into the habits of the rattlesnake and obtained some results which have served to shake my confidence in the opinions I had held as to the usefulness of his rattle. The observations are, as it will be seen, rather insufficient for a determination of the points in question, but it may be long before I am able to add to them, so I give them now hoping that some one with better opportunities for studying the ways of this interesting creature may either confirm my opinion or refute it.

The first and only living and active rattlesnake which I met on a carriage journey of some months' duration made during the past summer through that part of the Appalachian chain where these serpents most abound was in the middle of a road near the Kishicoquillas Valley, Pennsylvania. As the sound of my carriage disturbed the surly fellow in his pleasant basking place in the dusty way, he begun to sound his warning when we were over a hundred feet from him. Although quite accustomed to the sound, having had specimens captive for months at a time, I mistook it for that made by our "locust," the *Cicada rimosa* Say, nor did I perceive the error until my companion, Mr. A. R. Crandall, called my attention to the serpent when we were within forty feet of it. My wife and child, a little girl of eight years, who were in the carriage also mistook the noise for that made by the Cicada, which was abundantly familiar as it had been for a long time the most accustomed sound heard while we were travelling through the wooded mountain country.

I have found that the note of the rattlesnake is recognized by many persons as indistinguishable from the sound made by the Cicada. Professor Brewer, whose long experience in the service of the California Geological Survey gave him quite unrivalled opportunities for becoming familiar with the sound made by this reptile, tells me that he was on one occasion at least in great danger of being bitten by one of these animals on account of having

supposed that its persistent rattle was only the whirring of a locust. The range in pitch in the rattling sound of the snake is quite great; it is even difficult to understand how sharp it can be from a study of the sound made by the animals tamed by captivity, but at the same time the note of the locust is also very variable so that one is not able to discriminate by this means. The reader will doubtless have caught the main point towards which these facts so plainly tend, namely, that the imitation of the note of the locust may possibly be of high value to the rattlesnake. The Cicada furnishes the most satisfactory mouthful to many of our birds. Almost every observer of the life of our woods and fields, has seen a bird spying around a branch whence came the whirring of a locust; suddenly there would be an end of the monotonous sound, and a moment after the bird would be seen, beating the wings off the insect by pounding it against the ground. It is quite evident that any animal which preyed upon birds would gain a decided advantage from being able to imitate the sound made by the creatures on which the birds fed, so that we can well imagine that those snakes endowed with the power of attracting birds would be the best fed and multiply the most rapidly. From this point of view we can also understand how it is that birds have been seen fluttering around a rattlesnake without calling into play the unreasonable agency of fascination; the bird in this case being in search of his food and decoyed into the range of the serpent's spring.* It is a well known fact that birds, even those which have the best determined notes, are easily misled by sounds which approach, even though imperfectly, the calls of their species or the sounds of their prey, so that the imperfections in the note of a rattlesnake when considered as an imitation of the Cicada cannot count much as an argument against this view.

If this view be correct, then we must regard the rattle of the rattlesnake as a useful appendage, and not an instrument calculated to do it injury by warning its prey of its presence.† But it

* I had an opportunity, recently, of seeing a living Cobra di Capello in a state of excitement. The first impression was how entirely unlike any other serpent it was. The broad, flat banner-shaped neck upon the slender staff of the body would readily lead one to suppose that it was something very different from a snake. I can readily imagine that animals which had learned, by selection or otherwise, to shun creatures shaped like serpents, would be easily misled by the strange shape of the cobra and fail to avoid it or even be attracted towards it by the curiosity which animals often show to see closely or even smell any strange object.

† Rattlesnakes of the genus Crotalophorus make little or no noise with the imperfect

is by no means so easy, even if we allow all that can be claimed for natural selection, to account for the development of this appendage. The following seems to me the most satisfactory conception of its evolution, looking at the matter from Mr. Darwin's point of view. It is a fact well known, doubtless, to those who have observed serpents, though I find no mention of it in the works I have consulted, that many serpents, when in a state of excitement vibrate the end of their tail just as the rattlesnake does.* This movement is likely enough the same in character as that which occurs in the hinder part of the spinal column among higher animals under excitement. The wagging of the dog's tail is a rhythmical movement of essentially the same character as the movement of the rattlesnake. Taking the same line of argument as that adopted by Mr. Darwin with regard to the monthly phenomena observable among the mammalia, it could be claimed that the tendency to move the tail was explicable on the following grounds. During more than half the lifetime of the group of vertebrates, from the point of their presumed origin at the close of the Silurian down to the present day, the caudal portion of the body was used as the propelling agent. Fishes, with slight exceptions, propel themselves by a reciprocating movement of the tail. All conditions of excitement at once manifest themselves in the violent movement of this part of the body. Whether in flight or chase or under the influence of sexual excitement, this movement is the important element of success. It is by no means surprising that the motion which was for ages the point which natural selection operated most intensely, for those forms which had the capacity for making this alternate movement of the tail with the greatest rapidity would be most successful in flight or chase, should have survived its usefulness and remained as a mere feature of expression in most of our animals. It may be remarked in

rattles of the tail. In this genus, therefore, there could have been no advantage derived from imitation. It may be said, however, that the rattles which have little functional value in this genus, if making a sound be their real function, are even more irregular in number and shape than in the Crotalus. The truth probably is that there is an inherent tendency to form rattles in this group of serpents and these structures are seized upon by natural selection and made functional.

*Since the above matter was put in type, I have learned that Prof. Jeffries Wyman made a communication to the Boston Society of Natural History, concerning the occurrence of this movement in the tails of snakes other than the rattlesnake, some two or three years ago. I have failed to find any notice of the communication in the Proceedings of the Society, though there can be no doubt that this eminent naturalist should be credited with the priority on this point.

passing that the obstinate survival of the tail among the vertebrates may be accounted for by the intense bodily inertia, if we may so call it, which causes the energy of survival of useless structures to be proportionate to the length of time which they have been of use to the groups to which they belong. It is natural enough that a part of the body situated at one of the regions of manifold relations as the tail is, and unappropriated to any special function, should be put to use in various ways, as a prehensile instrument by some monkeys and other animals, or a building tool by the beavers, as a fly-brush by many others, etc.

Mr. Herbert Spencer has already suggested that the wagging of the dog's tail and similar movements of that appendage is in fact an escape of nervous force restrained from other modes of expression at the moment. Looking at the matter from this point of view, which is doubtless quite satisfactory, we may reconcile it perfectly with the views which have just been presented by supposing that the ancient and no longer functional channel of escape for nervous force, the tail, has remained the way of outlet for the suppressed energy of the animal. The older the channel the less easy it is to close it either by volition or by natural selection.

Be the cause of the persistence of the tail and its movement what it may, we are still justified in assuming as the starting point, that the progenitor of the rattlesnake had the alternating motion of the tail common among snakes. It is the opinion of some herpetologists that the rattles are the remains of the skins successively shed by the animal. The rate of development of the rattles, together with the fact that the skins of some serpents are more imperfectly detached from the region about the tail than at other parts of the body, makes this view very probable. Let us suppose that we had a group of poison-fanged serpents, accidentally tending to keep the tail skin in the peculiar fashion of rattlesnakes and that in some of these it was persistent enough to make the whirring sound of the Cicada when the tail was rapidly moved under excitement. These would survive and breed the most surely and so that feature would become hereditary. The great variability in the number of rattles in the different forms of rattlesnakes and the late time of their development, even among those which differ in no other regard, would seem to indicate that this structure has not yet been firmly fixed by long inheritance.

The reader will please not suppose that because I have boldly

followed the lead of the most advanced of the champions of natural selection that I am convinced of its sufficiency as an explanation of the great diversities which exist among animals or of its being sufficient basis for an explanation of the snake's rattle. But having been driven step by step from a decided opposition of the whole theory and compelled to accept it as a *vera causa*, though I think one much more limited in its action among animals than Mr. Darwin believes, I feel it to be my duty to examine every one of those points upon which I have relied for evidence against it.

It must be confessed that the case of the rattlesnake seems to me no longer the bar to the acceptance of the theory it once did.

REVIEWS AND BOOK NOTICES.

NORWEGIAN ZOOLOGY.* —The thoroughness and zeal shown by the Scandinavian naturalists in working up minutely the fauna of their shores is remarkable. While the land animals and plants of the country of Linnæus and Fabricius have been most zealously described, of late years no region has been so thoroughly explored with the dredge and net as the coast of Denmark, Norway and Sweden. We are also indebted for nearly all our most accurate knowledge of the natural history of Greenland, Iceland and Spitzbergen to the hardy and adventurous sons of the Norsemen, who first visited those islands for discovery and conquest. And it is a fact that in those countries where the land is most barren in organized life, the most valuable knowledge of biology has been acquired. With a few exceptions no one has done more to advance zoology in the highest sense than Professor Michael Sars. The marine zoologists of our own country owe him a peculiar debt of gratitude, for his writings have been a constant source of information, and better still a stimulus to do more thorough and lasting work.

The present memoir consists of detailed and beautifully illustrated descriptions of new additions to the marine fauna of the bay of Christiania. The figures have been drawn by Dr. G. O.

*Bidrag til Kundskab om Christianiafjordens Fauna. II. Af Michael Sars. (Prepared from his manuscript by his son, G. O. Sars.) Christiania, 1870. 8vo. pp. 114, with six plates.

Sars, one of the most eminent of the younger European zoologists, and a zoological artist of unusual skill.

The chief interest of the book is in the accounts and figures of the curious crustacean parasites found living on worms. These are degraded water fleas (Copepoda), like the Lernæans found living on the gills of fishes. The Danish naturalist Kröyer, recently deceased, was the first, we believe, to discover one of these parasites on a worm (Polynoë). Keferstein, a German naturalist, afterwards detected several similar forms, and more recently Steenstrup, Claparède and others have found a considerable number on different worms. These discoveries form a new chapter in the intricate subject of parasitism, and open up new relations in the study of biology.

NEW GALAPAGOS BIRDS.* — During the course of seven years' explorations in the greater part of Central America, the Cordilleras of the Andes in Columbia, Ecuador and Peru, Dr. Habel found time to visit the Chinca and Galapagos Islands. While he paid particular attention to the natural and physical history of these regions, he did not neglect the ethnology and meteorology of the countries he visited. He has returned with large collections stored up in New York, and we trust he may get time to arrange and publish the results of his travels. Meanwhile the birds of the Galapagos Islands have been identified, and in this article, a list of thirty-seven species of birds collected by him is given, with illustrated descriptions of seven new species. The authors state that they "are preparing for publication a memoir on the avifauna of this group of islands, in which [they] propose to embrace what has previously been recorded on this subject, as well as the results of Dr. Habel's arduous investigations."

RECENT BRITISH OSTRACODES.† — Whoever attempts the difficult and wearisome task of studying and describing the numerous shelled entomostraca which swarm in our pools, ponds and streams, and also in the sea, will find the occasional papers of Mr. Brady invaluable, while the present is a work ranking with the elaborate

* Character of new species of birds collected by Dr. Habel in the Galapagos Islands. By P. L. Slater and O. Salvin. (From the Proceedings of the Zoological Society of London.) May, 1870. 8vo. pp. 6, with cuts.

† A Monograph of the Recent British Ostracoda. By George S. Brady. (From the Transactions of the Linnæan Society, vol. xxvi. (no date) 4to. pp. 142, with 18 plates.

volume of Baird, and the more thorough memoirs of Lilljeborg, Fischer, Zenker, Claus, Sars, and others. The classification is that proposed by G. O. Sars, son of the distinguished Norwegian zoologist, Prof. Michael Sars, in his "Oversigt af Norges marine Ostracoder" published in 1865. The Ostracoda are represented by the little two shelled water fleas, about half a line or less in length, which swim over the bottom or creep over submerged plants. As remarked by the author, "the geographical and bathymetrical distribution of the Ostracoda is a matter of the greatest interest as illustrating the probable condition under which the various fossiliferous strata have been deposited." We might also add that the Ostracoda are found in the lowest fossiliferous strata, in company with the Trilobites and Nebaliads. So that a profound knowledge of the living species is absolutely necessary for the correct appreciation of some of the earliest traces of life on our globe.

THE AMERICAN ENTOMOLOGIST.— I regret to state contrary to announcement a year ago, that this magazine will not be continued during the coming year. The cost of publishing a paper so profusely illustrated with original figures is great, and the publishers, Messrs. R. P. Studley and Co., have lately concluded to discontinue it, as they have not met with sufficient financial encouragement. I have, however, since they so decided, purchased from them all the illustrations, and all interest in the magazine, and hope at no very distant day to recommence its publication myself. Meanwhile I take this means of thanking the many subscribers who, during the year, have sent in expressions of encouragement and appreciation, or who have signified their intention of renewing subscription. I shall ever be glad to hear from them on entomological subjects, and to render them what little service lies in my power.—C. V. RILEY, *St. Louis, Mo., December* 10, 1871.

BOTANY.

DISMISSAL OF THE LATE BOTANIST OF THE DEPARTMENT OF AGRICULTURE.—*Editors American Naturalist.* DEAR SIRS:—I have to request that you will place before the readers of the AMERICAN NATURALIST the correspondence herein enclosed.

Dr. Parry was thought to have performed the duties of Botanist to the Department of Agriculture to the entire satisfaction

of the previous Commissioner. His extraordinarily abrupt dismissal upon the incoming of the present Commissioner, following a course of vexatious treatment to which, he states, he was subjected by his Chief Clerk, does not seem calculated to win the confidence of scientific men in the present administration of a department in which they naturally feel much interest.

Very respectfully yours,

ASA GRAY.

DEPARTMENT OF AGRICULTURE,
Washington, D. C., September 27, 1871.

Hon. F. WATTS, *Commissioner of Agriculture.*

SIR:—In order to enable me to comply strictly with the regulations of this Department in regard to ordinary correspondence in connexion with my official duties as botanist, I respectfully ask to be furnished with written instructions on the following points. 1st. Should letters addressed to me personally, as botanist of the department, imparting or requesting information on botanical subjects, be answered and signed by me personally as botanist, or in the name of the Commissioner? 2d. In sending botanical specimens to be named, or in returning such as have been sent to me to name, should the accompanying letter be signed by myself as botanist or by the Commissioner?

Having heretofore exercised my own discretion in this matter, with due regard to the scientific interests of the department and to facilitate the business of my division, I desire to avoid any future misunderstanding by receiving definite written instructions on these points for my guidance. Respectfully yours,

C. C. PARRY, *Botanist Agr. Dpt.*

DEPARTMENT OF AGRICULTURE,
Washington, D. C., September 27, 1871.

C. C. PARRY, *Esq., Washington, D. C.*

SIR:—Your services as botanist of this Department will not be required after this date.

I am respectfully,

FREDERICK WATTS, *Commissioner.*

DEPARTMENT OF AGRICULTURE,
Washington, D. C., September 27, 1871.

Hon. FREDERICK WATTS, *Commissioner of Agriculture.*

SIR:—I have the honor to acknowledge your letter of this date informing me that my "services as botanist of this Department will not be required after this date," for which I sincerely thank you.

I respectfully request that you will designate some person from the de-

partment to-morrow to be with me in selecting my private property, books, etc., from that belonging to the Department.

Respectfully yours,

C. C. PARRY, *Botanist Agr. Dept.*

To the Honorable JUDGE WATTS,

U. S. Commissioner of Agriculture, Washington.

The undersigned, botanists, well acquainted with Dr. C. C. Parry, and having a high opinion of his ability, industry, entire probity and honorable character, as well as of his peculiar qualifications for the position, acting upon their view of the best interests of the science they represent, and sincerely believing that his dismissal must have taken place under some misapprehension, hereby respectfully solicit that the Commissioner would take into consideration the propriety of re-appointing Dr. Parry to the position of Botanist in the Department of Agriculture.

JOHN TORREY,
ASA GRAY,
WM. H. BREWER, *Prof. Agriculture in Yale College.*
DANIEL C. EATON, *Prof. Botany in Yale College.*

Harvard University Herbarium, November 22, 1871.

P. S.— A copy is forwarded to Messrs. Watson, Engelmann, and Canby, for their signatures.

DEPARTMENT OF AGRICULTURE,
Washington, D. C., November 27, 1871.

To Prof. ASA GRAY.

DEAR SIR:—Prof. Henry this morning placed in my hands the note of Profs. Torrey, Brewer, Eaton and yourself, asking me "to consider the propriety of reappointing Dr. Parry to the position of Botanist in the Department of Agriculture." The respect which I must necessarily have for a suggestion coming from such a source induces me carefully to review my action in the matter of Dr. Parry's removal; and my conclusion is, that my own self respect and especially the interests of this Department, forbid that I should reverse that which I did with care and reflection. I did not, to Dr. Parry himself, assign any reason for his removal, simply because he did not afford me any opportunity to do so. I did not see him afterwards, but I should add that it was quite acceptable to me that I was not called upon to assign reasons which it would have been as disagreeable to me to utter as for him to hear. Nor do I now desire to say any thing about Dr. Parry that might disparage him in the estimation of his friends.

I am, most respectfully, your ob't. servant,

FREDERICK WATTS.

Cambridge, Mass., November 30th, 1871.

To the Hon. FREDERICK WATTS, *U. S. Commissioner of Agriculture.*

SIR:— I have to acknowledge your favor of the 27 inst. in reply to the

memorial addressed to you by Professors Torrey, Brewer, Eaton. and myself. It still appears to me that the friends of Dr. Parry are entitled to know the reason of his summary dismissal by you,—all the more so that your letter intimates, without directly asserting, some moral delinquency on his part. I am still so confident that you must have been misled, that I respectfully ask leave to print your letter to me along with the memorial to which it is a reply; in case you still decline to furnish the charges upon which Dr. Parry's dismissal was grounded.

I am, sir, respectfully, your obedient servant,

ASA GRAY.

DEPARTMENT OF AGRICULTURE,
Washington, D.C., Nov. 8, 1871.

To Professor ASA GRAY.

DEAR SIR: — Yours of the 30th of November was handed to me yesterday by Professor Henry. If it were not that you say that my former letter to you "intimates without directly asserting some moral delinquency" on Dr. Parry's part, I would content myself by saying that my judgment dictated to me the propriety of Dr. Parry's removal. But I have concluded to put you in possession of the whole subject.

When I took charge of this Department, my first duty was to look into and to understand the divisions of subjects which make up its whole, the work that had been done, and the character and competency of each individual who had charge of that work. Among the divisions was that of the Botanist, with Dr. Parry in charge of it. My attention was called to the inquiry, how and to what extent the work of this division conduced to the practical operations of the Department. I found that nothing at all had been done by Dr. Parry beyond his attention to the preservation of the herbarium. This Department is designed to render the developments and deductions of science directly available to practice, that farmers and horticulturists may be benefited by them. The principles of vegetable physiology, their relations to climate, soils, and the food of plants, and the diseases of plants, which are principally of fungoid origin, it is clearly the duty of a botanist to investigate. If possible, he should throw some light upon the origin and condition of growth of the lower orders of cryptogamic botany. This is a domain into which I could not discover that Dr. Parry had ever entered, so far as his practical work here gave any indication. The routine operations of a mere herbarium botanist are practically unimportant.

In the course of my investigation, my attention was also drawn to letters written by Dr. Parry, which I deemed objectionable because of his mode of expression, wanting in perspicuity and not creditable to the Department. These things, and what I also learned that my predecessor had signified to Dr. Parry, to the effect that his letters should be submitted to him and for his signature before they were sent away, induced me to direct my chief clerk to have a conversation with Dr. Parry, and to say to him that, as the head of the Department, I was responsible for

whatever emanated from it, and that all letters on official business must be sent open to me, for my signature and frank. I returned with this message a sealed package for which my frank was asked. At another time I returned to Dr. Parry by my chief clerk, a letter which he had written and which I did not think proper should be sent, and which the Doctor passionately tore up and threw into the waste basket. This he subsequently apologized for to the gentleman he had thus insulted. On the 25th of September, after these various conversations between my chief clerk and Dr. Parry, he wrote another letter addressed to "My Dear Doctor." It had no other designation. For whom it was intended, I did not learn, or if I did I have forgotten. It concluded, "yours, 'officially,' C. C. Parry." I wrote on this letter, "This is not very intelligible in its last sentence; besides, the Botanist can sign no official letters. What his 'official' means I do not understand, but under the circumstances, I think it is intended for impertinence." It then occurred to me that I would dismiss Dr. Parry, but held the matter under advisement for two days, until the 27th of September, when I received a note from him, in which he requested me to furnish him with *written* instructions (underscoring the word), and which contained two queries respecting letters from the Department. I did not think that he was in want of the information he asked for, and my answer to his note was that the Department did not longer require his services. My conviction was then, and is now, that whatever may be the qualifications of Dr. Parry as a botanist, he was not competent creditably to discharge the duties which should devolve upon him in connection with this Department, and therefore, without passion or prejudice, I determined to dismiss him.

A word in reply to your suggestion about printing my letter and your memorial. I decline to be a party myself to any such proceedings. But if you will take the whole responsibility of it, I shall never complain that you have violated a confidence which I never intended to impose.

I am, very respectfully,

FREDERICK WATTS, *Commissioner of Agriculture.*

BOTANIC GARDEN,
Cambridge, Mass., December 11th, 1871.

To the Hon. FREDERICK WATTS, *U. S. Commissioner of Agriculture, Washington, D. C.*

MY DEAR SIR,—I have to thank you for your letter "Nov" [Dec.] 8th, in response to mine of Nov. 30.

You will permit me to remark, that the dismissal, without an hour's notice, of Dr. Parry from a position the duties of which he was thought to have performed acceptably to your predecessor, must of itself, if unexplained, cast an injurious reflection upon his character or conduct. Then your letter in reply to the memorial which solicited his recall, stating that the reasons for such dismissal were of a nature which it would have been as disagreeable for you to utter as for him to hear, and that you "do not now desire to say anything about Dr. Parry which might dis-

parage him in the estimation of his friends,"—all this certainly conveyed to my mind the conviction that some serious delinquency had been charged. It is with satisfaction, therefore, that I have read your letter now before me, obligingly written "to put [me] in possession of the whole subject." I learn from it that the reasons for Dr. Parry's summary and ignominious dismissal relate to some details of form in the mode of conducting official botanical correspondence, —to a momentary loss of temper in the presence of one of your subordinates (evinced by the mode in which he destroyed a letter of his which had been returned to him to be cancelled), and for which he duly apologized,—to the subscribing of a letter addressed familiarly "My Dear Doctor" [evidently some botanical correspondent] by the phrase "yours officially,"—that in some letters you found "his mode of expression wanting in perspicuity "(a fault into which more practised writers may sometimes fall),—and finally, that you did not discover in Dr. Parry the kind or degree of botanical qualifications for the post which you were entitled to expect, and deemed the services of "an herbarium botanist" practically unimportant.

As your letter has relieved my own mind from a painful anxiety upon this subject, it may have the same effect upon others, upon whose minds also your action had left the alternative of supposing, either bad conduct on the part of one hitherto highly esteemed, or of very hard usage towards him (it was thought through some misrepresentation of him or some misapprehension of yours). I think it proper and just, therefore, to make use of the permission you grant, and to take the responsibility of making public, in scientific circles, first, the correspondence between Dr. Parry and yourself, and second, that between ourselves.

I am, very respectfully yours,

Asa Gray

Extracts from Reports of the Board of Trustees of the Agricultural College of Pennsylvania, made by the Hon. Frederick Watts, 1865, 1868: — examples of "perspicuity," etc.

"If science and learning be useful at all, where can it tell with so potent an influence, as where it deals with the operations of a farm, which embrace a great number of mechanical and chemical forces, and involve the necessity for searching after philosophical truth?"

"The individual members of the Board of Trustees, have labored assiduously for several years to establish a school, where an education may be obtained which will qualify farmers' sons intelligently to pursue their fathers' business. They have been influenced by the belief that this object cannot be attained at any of the literary colleges of our State; that the knowledge and habits which they impart disqualify youth for such pursuits, and thereby defeat the object of the parent, and add nothing to the interests of agriculture."

"Our experience teaches us, that a farmer's son, graduated in such an institution, finds no place, ever after, in the domestic circle of his family:

he is actually driven, by his education, into the necessity of resorting to some neighboring town, in pursuit of a learned profession, where he soon forms habits of idleness and intemperance; and the result is, that the father not only loses the expenses of his education, but the son himself."

"These farms will all differ essentially in the character of soil and situation; and will be conducted under the eye of a skilful Professor of Agriculture for the purpose of testing and developing the thousand mysteries which now cloud the knowledge of the farmer. These experiments carried on under the direction of a scientific observer, who will constantly keep note of the weather, *the signs of the Zodiac*, the application of manures, and all the various actual and supposed influences which affect the growth of plants; and this, too, at three different points of the State, and upon different soils, cannot fail to produce an amount of information exceedingly valuable, and which could never be collected by individual exertion. Until now our Institution has never had the power of prosecuting these inquiries; but we now start upon a new career girded about with the strength of sufficient means, and we hope with great certainty to soon make it tell upon the Agricultural interests of the State."

POTATOES GROWING ABOVE GROUND. — I send you herewith, what appears to me to be a rather uncommon freak of nature. I remember an old ballad which ran something like this —

"They plant potatoes in the fall
Over there, over there,
And they dig them tops and all
Over there, over there,"

but I never knew of any authority for the potatoes growing on the stalk above ground until I saw it in the specimen I send. There were found in our potato field yesterday several stalks of potatoes having from six to twelve or more little potatoes on them, from the eyes of which are shooting the regular leaves. They seem in these specimens to grow from the axils, but in some other specimens they seem to be enlargements of the leaf-stem itself. — B. D. EASTMAN, M.D.

HELENIUM TENNIFOLIUM. — Specimens of this plant were presented by Dr. Foreman, having been found by him growing about three miles northwest of Baltimore, in the neighborhood of some cotton mills. As it is a native of the extreme southwestern States of Arkansas, Louisiana and Texas, it is believed that its seeds have been introduced in cotton bales from a southern port. The plants observed were few in number, as if recently established, but were in vigorous growth and have made abundance of seeds.— *Proceedings Maryland Academy of Sciences, Nov.* 6, 1871.

ZOOLOGY.

Carboniferous Reptiles of Ohio.—Prof. Cope made some observations before the Philosophical Society at Philadelphia on the extinct Batrachian Fauna of the Carboniferous of Linton, Ohio, based on studies of materials obtained by Prof. S. J. Newberry, director of the Geological Survey of Ohio. Twenty-seven species had been discovered up to the present time, twenty-three of which were referred to the following genera. Pelion Wyman, 1 ; Sauropleura Cope, 3 ; Tuditanus Cope, 4 ; Brachydectes Cope, 1 ; Oestocephalus Cope, 6 ; Cocytinus Cope ; Molgophis Cope, 1 ; Phlegethontia Cope, 2 ; Colosteus Cope, 3 ; Eurythorax Cope, 1.

Tuditanus, Cocytinus and Phlegethontia were described as new genera. The first represented Dendrerpeton Owen, but possessed thoracic shields. Plegethontia embraced slender snake-like forms without armature, ribs or limbs, and was allied to Molgophis. Cocytinus was defined as a branchiferous animal somewhat resembling Necturus, but without fore limbs and well ossified vertebræ.

Oestocephalus was defined as having the three pectoral shields, weak posterior limbs only present, head lanceolate ; ventral armature consisting of closely packed osseous rods arranged *en chevron ;* spines of the vertebræ fan-shaped. Three new species were described, one of which was the smallest of fossil Batrachia, being scarcely four inches long and represented by beautiful specimens. Two new species of Sauropleura, three of Tuditanus, one of Cocytinus, two of Phlegethontia and one of Colosteus (*C. pauciradiatus*) were added to the system. *Eurythorax sublævis* Cope was a large form of four feet in length with the pectoral shield very broad and nearly smooth.

Pelion and Tuditanus were pointed out as the broad-headed types. It was stated in conclusion that no reptiles proper had been yet discovered in the coal measures and that Sauropleura looked much like a Lacertilian with its long limbs, neck, etc., yet it had the armature of the belly and other structures of the Batrachia. This class has then forms resembling the serpents (Molgophis), lizards (Sauropleura) and crocodiles (Labyrinthodon) among true reptiles.

Note on the Prairie Dog.—The graphic account of the habits of *Cynomys ludovicianus* given by Prof. Jillson in the Naturalist for March, 1871, refers to the small amount of water used by it.

Our experience with a pair which were domesticated in my laboratory for a month, agrees with his, so far as regards the water; when offered it was either refused or merely tasted. Of milk, however, they were very fond, and drank from the same dish with a cat, lapping it up greedily and seldom stopping while any milk remained; in less than fifteen minutes, however, a looseness of the bowels always appeared, which continued for a day or two. In uttering their peculiar cry, they seemed to stiffen the whole trunk and "rear" into a very comical attitude. Curiously enough, they not only burrowed, but were vigorous climbers, would run up my legs and get upon my shoulders and even head; but they seemed to have little power of estimating height, for they continually tumbled from the chairs and tables, often striking upon the tip of the nose, whereupon they made comical passes in front of the nose with the front-paws; one of them finally was killed by falling from a window, to the seat of which he had climbed by means of a table-leg. The other has been described, and I may hereafter give some account of its structure.—BURT G. WILDER.

ORNITHOLOGICAL QUERY. — I have seen a partially albino Robin, in which numerous pure white feathers are scattered through the otherwise normally colored plumage. This is of very common occurrence, but the circumstances under which the specimen was secured open an interesting question. It was one of a flock in which were several partial albinos like itself, and one wholly white bird. Is it probable that, as suggested by Mr. Glover, these speckled birds were the offspring of the white one and a normally colored mate?—ELLIOTT COUES.

BIRDS FOUND BREEDING IN THE CATSKILL MOUNTAINS.—During a visit to the Catskill mountains, in the second week of July, I found the following birds breeding there:— *Regulus satrapa*, *Dendrœca coronata*, *Sitta Canadensis*, *Troglodytes hyemalis*, *Junco hyemalis*, *Dendrœca virens*, *D. Canadensis*. The last four birds are common throughout summer in all the higher hills of Ulster and Sullivan counties, and the mountains of Pennsylvania. The golden-crested wren, I noticed only on the summits of Round Top, and one or two others of the highest peaks. On the eighth of July, I saw several young birds, apparently not many days from the nest. They were attended by their parents, and hid themselves from observation, amid the densest hemlock boughs. At

times, the old birds uttered a lisping sort of warble, beginning like that of *Dendrœca striata*, but winding up with a few sprightly notes, similar to those of *D. virens.* The young had no notes, save the usual faint chirp. What is the southernmost observed breeding locality of this bird?

Petrochelidon lunifrons is the commonest swallow in the Catskills, far outnumbering all the other species combined. It breeds in great numbers under the eaves of every barn and deserted house. In no other eastern locality have I noticed it in such great abundance as in these mountains. — T. MARTIN TRIPPE.

FISHES AS SURGEONS.—In walking through the long dank grass of the forest, an almost imperceptible, minute sort of tick attached themselves to the ends of our trousers, and from thence up our legs and buried themselves in the flesh, causing a most annoying sensation of itchiness. The whole party soon became victims to the irritation of this little pest, and scratched and exclaimed without measure. One of the Caribs, on hearing the cause of our vexation, said that the remedy was near, advising us to go without one moment's delay and lie down in the river, and that there was a small fish in the creek which would almost immediately extract the tick if it had not burrowed too far into the flesh; we all did as I fully expect you to do, gentle reader, on hearing this novel style of surgery, burst out into uncontrollable fits of laughter; but on Mr. C— and the manager's assuring us that the blacks only spoke from long experience, and that they themselves had more than once proved the efficacy of the cure,—warning us at the same time that the tick, if not soon extracted, would become a very severe sore; we at last, but without one atom of faith in the experiment, assented to the proposal, and commenced to undress without further opposition.

We bathed, and then in compliance with the Carib's directions, lay down quite still in the shallowest part of the stream. In a few moments, I felt something very sharp strike against several parts of my body; cautiously raising my head, and looking down towards my legs I saw a swarm of very small fish, wriggling and swimming around me, continually bobbing their little heads at my person, and readers, ridiculous, incredulous as I fear my story will sound in the ears of the unlearned, positively the fish not only picked off the tick which were outside the flesh, but actually extracted those which had burrowed beneath the skin.—*Exchange.*

A SEA BIRD INLAND.—The cold, northeast storm of the past few days brought us a rare visitor in the shape of the Little Auk, *Mergulus alle* L. Two individuals were captured in full winter plumage and plump, though with empty stomachs. Their occurrence thirty miles inland is somewhat remarkable. Allen records the capture of a single specimen at Greenfield, Mass, on the Connecticut, and Linsley places the species among the birds of Connecticut on the strength of one captured near Martha's Vineyard. It is found on the coast of New Hampshire, New York and New Jersey in winter, and was therefore to have been expected on our own, but this is its first appearance in Middletown.—G. BROWN GOODE, *Middletown*, *Connecticut*, *November* 18*th*.

[The same storm drove a lot of the little auks to Middletown, Mass., and large numbers were taken along the coast of Massachusetts. Maynard says he has seen it in Florida.—EDS.]

NOTE ON HEMIRHAMPHUS (RICHARDI?)—An ichthyological friend requests us to make a note of the unsuspected abundance of this fish on the North Carolina coast. It occurs at certain seasons in immense numbers, swimming near the surface in schools so large and dense that specimens may rapidly be secured by simply jerking a naked hook through the water.—ELLIOTT COUES.

OCCURRENCE OF THE ORCHARD ORIOLE IN SOUTH CAROLINA.—Dr. Coues, in his "Synopsis of the Birds of South Carolina," enumerating the Icteridæ, says of the Orchard Oriole (*Icterus spurius*), "*rare*; chiefly migrant; some probably *breed*." My own observations in this State differ somewhat.

On the 28th of June, this last spring, and a few days after my arrival at Camden, I happened to be walking across one of the public squares of the town, when among the songs of many other birds, I thought I distinguished the note of the Orchard Oriole, and the next moment caught sight of the familiar but unexpected person of this little dweller of our northern orchards. Flitting among the branches of a tree near by, every moment or two he sang his cheerful song, and while I stood watching, as he busily searched among the leaves for insects, his more sober partner joined him, holding in her bill a worm, which, however, she soon carried off, flying towards the other corner of the square. I followed, and in a few minutes after discovered the pendant nest,

hanging from one of the lower boughs of a small oak and not more than fifteen feet from the ground; drawing the limb down to me, I found that it contained four nearly fledged young. While I was engaged in examining these, the two old birds kept up a terrible chattering, flying so near, that at one time I thought they were about to attack me. One of the young ones I tried to rear in a cage, but failed in my attempt.

Since then, I have discovered five other nests, three of which contained half fledged young, the other two had been but recently deserted, and in one case, I saw the parent birds feeding the fledglings in the neighborhood of the nest.

These nests were all found from the 28th of June to the 19th of July, and were with one exception in the thickly inhabited portions of the town and on the edges of the public squares. I do not doubt but that if I had made especial search for them, I should have discovered many more; for in various parts of the town, I saw the black and chestnut of their plumage shining amidst the topmost boughs and heard their clear and pleasant songs sounding in every direction around me. I counted fifteen pairs of these birds, of which I shot four. They seemed nearly as familiar as I have noticed them at the north, and from all I can learn are thought one of the common species of birds at this place, and are called *Gold-finches*, why, I cannot conceive, as the title would more nearly apply to the Baltimore Oriole. These facts would, I think, prove them not *rare*, at least in this portion of the state, and establish the fact of their *breeding* here.

But, from Dr. Coues not having discovered a nest of this species at Columbia, during two years' observations at that place, which is not more than thirty miles distant, I am inclined to believe that the Orchard Oriole is very partial to certain favored localities, resembling in this respect the Baltimore bird, which most certainly seems to prefer one place to another, although it may be but a few miles distant. Also, during three days spent at a small village, but eleven miles from Camden, I neither saw nor heard one, from the time I left the precincts of the town until my return, although I looked and listened for them especially, and on enquiry found that the residents considered the Gold-finch quite a rare bird in their portion of the country. Audubon speaks of this species as not uncommon in Louisiana during the breeding season.

Of the four male birds I shot, but one possessed the full per-

fection of plumage of the fourth spring, as mentioned by him, having the deep chestnut color covering the whole lower parts, and the glossy blackness on the head, wings and tail feathers; the others were birds of the second or third years. The nests I found, were *all* formed entirely of grass, coarse without and finer within, like those Audubon speaks of as usually built in Louisiana.

On the 30th of July, I observed a number of these birds, not less than twenty-five or thirty, congregated together on the top of a decayed tree, which stood near the edges of a large cultivated field; at my approach they flew off, and since that time I have neither seen or heard a single individual of this species, and they seem to have entirely disappeared from the place, although the autumn is near at hand.—H. S. KEDNEY.

TULIP TREES DESTROYED BY BARK LICE.—I send you some specimens of Coccidæ belonging to the genus Lecanium, and which I think is an undescribed species.

Mr. P. R. Uhler of Baltimore writes me that it is new to him, and undescribed in the many works which he possesses treating of the Coccidæ. It is very near to the *Lecanium juglandis* Bouché.

I send you some of the deserted scales, also some of the larvæ as they appear at this date. These bark lice are very destructive to the Tulip tree (*Liriodendron tulipifera*). We had some beautiful specimens of these on the college grounds, which have been entirely ruined.

These insects are ovoviviparous. The eggs, which are one-fortieth of an inch in length, appear in July almost filling the female. In August the gravid female contains the embryo in all stages of development, from the undeveloped egg to the active larva. From the last of August to the first of October, the larvæ leave the scale through a central opening in the under surface.

The larvæ are in form and color quite like the common sow-bug, one-twenty-fifth of an inch long, antennæ eight-jointed, abdomen nine-jointed, the posterior joints being deeply sinuate, with a long seta on each side. After wandering about the tree from eight to ten days, they become attached to the bark of the trunk and limbs by little peripheral filaments, two on each segment. The color soon turns from brown to black.

The imago is perfectly formed in June. The turtle-shaped scale being then five-twentieths of an inch long, of a dark flesh color,

from which there exudes a sweet fluid which attracts swarms of flies (Diptera), bees and wasps, and falling on the leaves, forms a dark sticky wax. On the underside of the fully formed adult females are four cottony lines extending from the angles to the centre. In October the emptied scales fall from the trees.

The rate of increase is enormous, each female producing thousands of young. Two or three years are sufficient to destroy a large, vigorous tree.—A. J. Cook, *Agricultural College*, *Lansing*, *Mich.*

Instinct or Reason in the Robin?—A pair of Robins (*Turdus migratorius*) had, for three years, built their nests and reared their young on the trees in front of my house. The fourth year they decided for family ends to change the trees for the beams of of a new shed. There they built their nest; and soon four eggs were seen in it; in due time the young appeared. As they were in plain view from our window, and were also exposed to danger from boys, cats, and other enemies, we watched them very closely. After a few days, the birds had grown too large for all to remain in the nest, and one was seen on the beam outside. As cats were whetting their appetites looking at it, I determined to protect it at all hazards, and went near to watch. The parents seemed as fearful and anxious as I, keeping both of them on the wing, going to and from the nest, with much flutter, and noise and talk. I noticed they were, bringing, what seemed to be nest material, in addition to the food for the young. The next morning at daylight a new nest close beside the old one, was completed, and two of the young placed in it. Here two in one, and two in the other nest, they were cared for until they could fly. The next year they began their family duties near the same spot, but a fearful gale blew down the shed, with its nest, eggs and birds and they have never nested on the place since.—Rev. S. A. L. Drew, *South Royalton*, *Vt.*

Laboratory for Marine Zoology.—Dr. Anton Dohrn in a letter to Professor Agassiz, who has communicated it for publication in this journal, writes that he has matured a plan which has for many years been in the minds of many zoologists; that of establishing a large laboratory for marine zoology in the Mediterranean. He has obtained permission of the authorities of the city of Naples to construct a large building at his own expense, in the Villa Reale at Naples close to the sea, containing a large aquarium for

the public, and extensive rooms for naturalists of every country. Dr. Dohrn, with two or three other German zoologists, will settle there and conduct the administration of both the aquarium and the laboratories. He wishes that information regarding this proposed laboratory be widely extended in America, and earnestly invites all who may go to Naples to visit the aquarium. An annual report of the work done and progress made at the zoological station will be published. A committee has already been formed to give farther dignity and importance to the project, consisting of Messrs. Hemholtz, Dubois-Reymond, Huxley, Darwin, Hæckel, Leuckart, Van Beneden, etc., and in this country Professor Agassiz.

HYBRIDS.—[Simply remarking that we strongly suspected that the supposed hybrid between the cat and raccoon was nothing more than a cross between an Angola and a common gray cat; a variety that is well known in this vicinity and in every way corresponding to the description given; and that we thought it best to let the communication printed in the October number call forth comments on this oft recurring question of hybrids; we accordingly give the following careful summary of the subject with thanks to Dr. Gill for treating it in so concise a manner.—EDS.]

To the Editors of The Naturalist.—I find in the number of "The Naturalist" for October (p. 660) which has just come to hand, a notice by Col. Higginson, endorsed by Prof. Jenks, of an alleged hybrid between a raccoon and cat, which is extremely tantalizing. No information as to the structural characteristics of the animal is given, and scarcely any as to other points, and yet it is not too much to say that the authentication of such hybridity would revolutionize physiology, for certainly nothing like it has hitherto been made known. Remarkable as is the hybridity of the ram and doe roe-buck (*Capreolus Europeus*) recorded by Hellenius, it pales into insignificance when compared with hybridity between the cat and raccoon. We have, in the last mentioned animals, not only representatives of distinct genera and families, but of *primary groups* (Superfamilies) of the fissipede carnivores, charactized by differences of as great morphological value, as, for example, those between the horse and rhinoceros: those differences, in the animals in question, are exhibited especially in the osseous, digestive, and generative systems, and it is therefore desirable to

know in what manner these systems are modified in the supposed hybrid; the living animal could readily be examined as to its dentition (the number of the molar teeth and their characteristics), the feet (whether digitigrade or plantigrade and whether tetradactyle or pentadactyle), the head (whether abbreviated and cat-like, reflecting the diminished number of teeth, or whether prolonged into an attenuated muzzle), and especially the character of the snout, whiskers, the claws, the tail and the pelage. The very vague information that has been furnished respecting the form, walk, tail and pelage is very insufficient, and conveys no clear idea as to the animal's peculiarities. No clear idea, either, is obtained by the mere reader from the statement that "the animal when taken up by the tail, turned upon the aggressor with a fury far beyond that of a common cat." Although my experience with cats under such conditions has been limited, I cannot conceive how more fury can be manifested than I have seen exhibited by one cat when subjected to such an interesting experiment. A clue is indeed furnished by the opening paragraph of Col. Higginson's remarks, namely, that the animal "struck [him] at first as being the handsomest *cat* [he] had ever beheld," and after this significant admission, it is more than probable that its characters would only require to be contrasted with those of an ordinary cat. It may be added that the wild cat (*Lynx rufus*) has "pointed and tufted ears" (which the raccoon has not) and hybridity between a domestic cat and lynx would not be improbable.* My acquaintance with you, Messrs. Editors, assures me that you must have entertained considerable doubt respecting the reliability of such an account, although you have made no comments, and you would confer a boon on science if you would procure a *photograph*—not a drawing which might reflect, unintentionally, the imagination of the artist—of the animal in question. Until better evidence than has yet been brought forward is offered, naturalists will not only be excused for doubting any such hybridity, but would be inexcusable for *not* doubting it, and you gentlemen will, I doubt not, concur in this sentiment. I scarcely need remind you of the physical difficulty a male raccoon and

* It is, of course, not suggested that the animal in question *is* necessarily a hybrid at all, much less between the cat and lynx; the character of the tail alone rendering such origin highly improbable; it is merely intended to indicate *within* what limits hybridity might be credible.

female cat would encounter in the prosecution of their amours, and that therefore if such a monstrous union were possible, the marriage must be between a cat and female raccoon. But until most cogent evidence is adduced, I must remain sceptical as to the possibility of any fruitful union whatever.

Of course, no reflection is cast upon the eminent gentlemen who published the account of the remarkable animal, and who have only repeated what they heard; they, probably not being very familiar with the order of mammals in question, naturally believed in and reflected the opinions of others. My only object in this communication is to elicit more evidence while it may readily be obtained, and I may be allowed to express the hope that when the animal — happily for the interest of science! — dies, it may be reserved for a more worthy fate than to leave its skin stuffed for a museum: it should, of course, be submitted to the examination of a critical anatomist.

In conclusion, a few words respecting the nature of the evidence required in alleged cases of hybridity may be serviceable. In view of the constant statements respecting hybrids circulated in various publications, affirmations and beliefs are not sufficient. Hybrids partake of characters peculiar to each parent, but modified by the sex of each parent. Therefore, all the men of China, Me., might swear they saw a cat and raccoon *in coitu* (and in view of the strength of the sexual instinct, the allegation might not be wholly incredible), and all the men of Taunton might swear that they believed that the offspring of one of the animals was the result of such amours (and in view of the credulity of man and the general ignorance respecting nature, the *reality* of such *belief* would be quite credible!) but all such affirmations and beliefs would not meet the requisites of the case, *unless* the offspring shared characteristics of each parent, and even if it were further sworn that the female had been precluded from intercourse with another animal, it would be no further evidence, for unless the allegation was confirmed by the characteristics of the animal, we would still have infallible nature against truthful and at least fallible man. — Theodore Gill.

GEOLOGY.

Geology of the Phosphate Beds of South Carolina. — Dr.

A. S. Packard, Jr., made some remarks on the geology of the phosphate beds of South Carolina. During a recent visit to Charleston, he had observed the phosphate diggings on the Ashley river, and at a locality on the northeast railroad eight miles from Charleston, but through the courtesy of C. C. Coe, Esq., Superintendent of the Marine and River Phosphate Mining and Manufacturing Company, and Dr. C. U. Shepard, Jr., he had enjoyed special facilities for studying the Quaternary, or Post Pliocene formation in which the phosphate bed occurs, having made two excursions in company with these gentlemen on the Company's steamer Gazelle. He was also indebted to Prof. C. U. Shepard, Sr., for much valuable information regarding the chemical as well as geological history of these interesting beds. Analogous beds have been discovered in the later tertiary of England near Cambridge, but they are becoming exhausted, and manufacturers of superphosphates are now importing large quantities of the crude phosphate rock from Charleston, S. C., as well as the phosphate, or apatite, rock from the Laurentian formation of Canada, which Dr. T. Sterry Hunt, the distinguished chemist of the Canadian Geological Survey, believes to have resulted largely from the decomposition of shells, especially those of Lingula.

The phosphate beds of South Carolina are spread over an area along the coast one hundred miles along, and about twenty miles in breadth; the formation is not continuous, being sometimes, as stated (in conversation) by Prof. C. U. Shepard, Jr., replaced by ferruginous sand. It has already been largely used as a fertilizer for worn out lands of the Sea Island cotton region, and promises from the unlimited supply of the rock, to become a large industrial interest of the state, six million dollars having already been invested in lands and mining and manufacturing materials by northern capitalists alone.

The relation of the phosphate beds to the Quaternary formation of the state and of the latter to the glacial beds of sand and clay of the northern states, were, however, the principal points he would allude to. At a celebrated locality of Quaternary fossils at Simmon's Bluff on Wadmalaw Sound, about thirty miles by steam from Charleston, he made with the kind and generous aid of Dr. Shepard, Jr., a large collection of fossils, from a bed of sand and mud about four feet in thickness. This bed corresponded with the marine clays of New England and Labrador, and the ancient sea

bottom with its multitude of shells, which remained just as they had died in their holes, reminded him of an ancient raised sea-bottom at Hopedale, Labrador.

These clay beds graduated into clay and sand, containing a ferruginous layer, supposed by Dr. Shepard, Jr., to be the horizon of the phosphate beds. These beds correspond to the beds of clay at Gardiner, Maine, where Sir Charles Lyell discovered the bones of the Bison and Walrus. They contain bones of the Megalonyx, Mastodon, Elephant, Tapir, two species of Horse, Peccary, Rhinoceros and Manatee. The sands graduate into the beach sands of the close of the Quaternary, just as do the Bison and Walrus beds of the Kennebec river. The phosphate beds, then, were probably rolled masses of Eocene rock crowded with shells, mingled with the bones of the animals above mentioned, deposited and arranged by the waves of a shallow sea a few feet deep. This sea was much shallower even than that which covered the ancient sea bottom beneath, which must have been only from one to five or ten fathoms deep, as the same shells are at the present day thrown up on the neighboring beaches in great abundance, and he had dredged some of them at a depth of from five to thirty feet at Beaufort, N. C.

After their deposition, the carbonate of lime of the shell marl of the Eocene rocks had been replaced by phosphate of lime. How this had been effected, and whence the phosphate of lime was derived, was a question still unsettled by chemists. He alluded to the theory of Prof. Shaler that this phosphate deposit had been formed at the bottom of the Gulf Stream, which, according to that geologist, had probably flowed over the site of the present phosphate beds; and in opposing the theory suggested that the phosphate beds were deposited in shallow water, perhaps lagoons as suggested by Prof. Holmes, as they rested in a shallow water deposit above alluded to. There was no apparent evidence, as well shown by the facts published by Tuomey in his geological survey of South Carolina, of a depression of the coast. On the other hand there is no apparent evidence of glacial action on the coast, since the Quaternary sands are marine or aerial, and Tuomey states that he has nowhere in the state of South Carolina seen any angular blocks, nor a pebble a foot in diameter. Moreover, the life of the Quaternary in this state indicated even a warmer climate than at present obtains.

Since these remarks were made, he had met by accident with

the paper by Desor, than whom no one can speak with greater authority, in which he has made a comparison* between the glacial marine beds of the North and the marine coast deposits of the Southern states, parallelizing the deposits in a masterly manner. His remarks entirely confirm the views given above. One difficulty Desor had in parallelizing the Laurentian beds of the North with those of the South containing the remains of land animals, was the apparent absence of the remains of land animals in the clays of the North, but since then teeth of the bison have been found at Gardiner, Maine, in the upper part of the clays. It may also result from farther investigation that the phosphate beds were laid down at a later period than we have supposed; at the time when the great mammals found in the cave at Phœnixville by Mr. Wheatley flourished, perhaps during the earlier portion of the river terrace period when the mammoth and mastodon lived both in the northern and southern states.

Thus, the parallelism between the Quaternary beds North and South would seem to be even more exact than Desor twenty years ago could make it with his data. The climate gradually grew warmer from Labrador to Florida; the Gulf Stream did not apparently change its bed during the Quaternary period; the oscillations of level of the coast of South Carolina were slight and involved but a few feet, where in Canada and Labrador the rise and fall involved several hundreds; and the denudation effected in the North by land ice, was caused in the South by oceanic currents, waves and atmospheric agencies. There are apparently no facts to show that while the glaciers lined the coast of New England, the waters of South Carolina were not as warm, if not warmer, than at the present day, from the effects of the Gulf Stream. — *Bulletin Essex Institute.*

Deep Sea Explorations. — The expedition by the Coast Survey, under the charge of Professor Agassiz and Count Pourtales, to explore the sea at great depths in the Southern Atlantic and along the Pacific coast, revives the interest in the remarkable discoveries made by the late English deep-sea dredging explorations in the Mediterranean Sea. It seems, as "Nature" remarks, that Humboldt, as long ago as 1812, maintained that

*Post Pliocene of the Southern states and its relation to the Laurentian of the North and the deposits of the valley of the Mississippi. By E. Desor. American Journal Science and Arts. 1852. Vol. 14. p. 49.

such a low temperature exists at great depths in tropical seas as can only be accounted for by the hypothesis of undercurrents from the Poles to the Equator. The temperature soundings taken on the last English expedition show that the bottom of the sea off Portugal, below one thousand fathoms, ranges from thirty-nine to thirty-five degrees, or about the freezing point. In the Mediterranean the temperature beneath the hot surface stratum of water is uniform to any depth—namely, about fifty-five degrees. It is naturally inferred that in the Atlantic and Pacific oceans an undercurrent of polar icy water is flowing southward under the warmer tropical waters; and this is sustained by the discovery at great depths of polar animals in the seas of Florida and Cuba. The English expedition under Professor Carpenter, the well known physiologist, has also detected the existence of an outward undercurrent in the Strait of Gibraltar, which carries back into the Atlantic the water of the Mediterranean that has undergone concentration by the excess of evaporation in its basin. Professor Carpenter confirms the theory previously urged by Captain Maury, that the cause of the superficial in-current and the deep out-current is to be found in the excess of evaporation, the Mediterranean water being from evaporation denser than the water of the Atlantic. Carpenter then compares the polar and equatorial areas, and shows that there is a tendency in the former to a lowering of level and increase of density, which places it in the same relation to the latter as the Mediterranean bears to the Atlantic.

Coal Beds in Panama.—In a paper read before the Geological Section of the British Association, Dr. Hume stated that, during a recent residence upon this isthmus, he learned that a series of seams of coal had been found in a secluded and primitive portion of the country, not far distant from the railway. He had procured and analyzed some specimens of the coal, and had found 75 per cent. of carbonaceous matter, the balance being water and ash, and a very small quantity of sulphur. The coal possessed a fair heating and large illuminating power.

MICROSCOPY.

Angular Aperture.—An anonymous querist in the "Monthly Microscopical Journal," incidentally to asking the aperture of a certain lens, urges the importance of angular aperture as an ele-

ment in the construction and study of objectives, and intimates, which is hardly saying too much, that the peculiar qualities of the objectives depend more on their angular aperture than on their focal lengths. "Focus and aperture are in fact both essential factors in the denomination of an object-glass, and where a difference exists in either we must keep in mind that we are comparing different things, and not the same things with differing qualities." The estimation of any angular aperture, so well expressed by "B," is perfectly familiar and undisputed among experienced microscopists, although its exact bearings are not always easily apprehended by beginners; and that microscopists need occasional caution in regard to it may be inferred from the case in point, where an accomplished writer stated an extraordinary performance of a lens without mentioning the range of its apertures or the aperture at which he worked it. The peculiar and entirely independent qualities of lenses of low and of high angles are everywhere understood alike; but the extent to which success has been attained in this country in the construction of high angles cannot be appreciated abroad when "B," evidently well informed on other points, would not be surprised to hear that a one-fifth of excessive resolving power had an angular aperture of 150° or 160°. Any one in this country would be "surprised" to hear that its highest angle was less than 170°.

Makers should always engrave the angular aperture upon the mounting and on the boxes of their objectives. The neatness and sufficiency of this plan, however, is marred in the case of many modern objectives whose screw-collar adjustment gives a wide range of powers and angles. Exactly at what point of adjustment the measurements should be made in these cases is one of the most difficult points to be settled in endeavoring to obtain a uniform nomenclature in regard to the works of different makers. At least for the present, until some standard degree of adjustment can be agreed upon, both the highest and lowest figures should be given where the range is considerable.

Passage of Corpuscles Through the Blood-vessels. — The "Monthly Microscopical Journal" reviews a paper on the subject read before the Royal Society by Dr. R. Norris. Previous hypotheses fall short in regard to the most singular and important part of the process. The question is less how the corpuscles get

out, than how they get out without leaving any trace of their passage through the wall. Observers are agreed that both red and white corpuscles pass out of the vessels through apertures which, manifest during the period of transit, can be seen neither before nor after that time, and that it is essential to the process that the corpuscles shall cohere to the wall of the vessel and shall be subsequently subjected to pressure from within. The physical conditions essential to the passage of a rigid body through a colloid film, as when a solid body passes through a soap-bubble without breaking it, are present in the case of the minute blood-vessels and the corpuscle, and are as follows;—an intimate power of cohesion, either mediately or immediately, between the film and the body, a certain amount of pressure from within, and cohesive plasticity of the substance of the film so that the breach in it may become united as it descends upon the opposite surface of the body which is being extruded.

Cutting and Staining Tissues.—Mr. E. Ray Lankaster recommends, in the "Quarterly Journal of Microscopical Science," that a small piece of tissue be enclosed in a metal box and frozen by means of a freezing mixture. It is then held between pieces of pith in wooden forceps (or an American clothes-peg) while sections are cut by a razor cooled in snow, the cutting being performed in a cold room. Three razors are used that two may be cooled while one is used. The sections are first placed in a one-half per cent. gold chloride solution, or in silver nitrate solution if desired. After five to seven minutes they are transferred to distilled water and soaked for a few hours. They are then placed in water acidulated with lactic acid to reduce the gold chloride, and after the red-violet color is fully developed they are teased out, if necessary, and mounted in glycerine.

Adulteration of Tea and Coffee.—According to Dr. Hector Helshan's paper on the employment of the Microscope in analysis, before the South London Microscopical and Natural History club, coffee drinkers are liable to be treated to a decoction of roasted coffee-berries, chicory, poor flour, stale sea-biscuit, tan-yard refuse, peas, beans, and saw-dust. Some of these modern improvements may be escaped by buying the coffee unground. Dainty tea-drinkers will notice with interest that the Chinese export teas rendered attractive by the salts of copper, lead, and iron,

and cheapened by mixture with the refuse tea-leaves from the kitchens. Other leaves are largely prepared and sold as tea, and the process of improvement is further carried on by the importers at home. Willow leaves have been much substituted for tea, and have been said to be a good substitute.

ANOTHER ERECTOR.—A flat minor above the eye-piece was exhibited by Mr. E. Richards, as an erector for the microscope, at the October meeting of the Royal Microscopical Society. He uses a glass plate platinized in front. This little erector is cheap and easily used when the microscope is in a vertical position. It is not, however, easily applicable in an inclined position of the instrument; and it is liable to narrow the field of view. This is a modification and adaptation of Mr. E. T. Newton's apparatus published in the "Quarterly Journal of Microscopical Science," July, 1871.

AMERICAN MICROSCOPICAL SOCIETY OF THE CITY OF NEW YORK. —Rooms: Mott Memorial Building, 64 Madison Av., New York. Officers: *President*, F. A. P. Barnard, S.T.D., LL.D.; *First Vice President*, J. E. Gavit; *Second Vice President*, H. G. Piffard, M.D; *Recording Secretary*, J. W. S. Arnold, A.M., M.D.; *Corresponding Secretary*, R. A. Williams, Jr., A.M.; *Treasurer*, E. C. Bogert; *Curator*, Samuel Jackson; *Librarian*, J. H. Cornell; *Trustees*, T. F. Harrison, C. Van Bunt, W. H. Atkinson, M.D., D.D.S., S. G. Perry, D.D.S., D. H. Goodwillie, M.D., D.D.S. —*The Medical Record.*

IMPROVED APPARATUS FOR DRAWING WITH THE MICROSCOPE.— Mr. E. T. Newton proposes, for microscopical drawing, a steel reflector partially covering the eye-lens and mounted with a provision for rotation, so as to be easily adjusted to use with the instrument inclined at any angle. The Beale neutral-tint reflector, etc., should be mounted, for those who prefer to use it, with a similar rotating movement. This substitute for the camera has the additional advantage of being an erecting arrangement.

MICRO-SPECTROSCOPE.—Mr. H. G. Bridge states in the "Monthly Microscopical Journal" that it is perfectly feasible, with Mr. Browning's bright-line micrometer, to record or map the spectra observed, so that the positions given shall be correct to the unit of the micrometer circle.

Protoplasmic Life.—Mr. Crace-Calvert stated that life will become manifest in the albumen of a fresh egg mixed with pure water after an exposure of fifteen minutes to the atmosphere. Experiments in spontaneous generation are often vitiated by momentary exposure to the air.

NOTES.

Prof. Agassiz has published a letter in regard to the expedition in the Hassler, in which, after stating that some published statements are incorrect in many particulars, he says:—

"The Hassler was built for the coast survey work of the Pacific shore of the United States. Any work undertaken on board this vessel, is, therefore, entirely subordinate to that of the regular operations of the survey. As she must, however, necessarily make the tour of the South American continent, in order to reach her destination, Professor Pierce, the Superintendent of the Coast Survey, has thought it wise to organize a scientific party, consisting of men who might render the voyage in the highest degree useful to science, as well as to the special interests of the survey itself. To this end he has provided a dredging apparatus in connection with the hydrographic operations, thus continuing on a larger scale the work so admirably conducted under his auspices in the Gulf of Mexico during the last five years. The wider range thus given to these operations will, of course, greatly enhance the value of the previous work, and lay the foundation for much more effective researches in the future.

I consider myself fortunate in being connected with this voyage, doubly so because the companions with whom I am associated are men of tried ability, some of them having a larger experience than my own in special details of the work, while Captain Johnson, commander of the Hassler, adds to his professional skill a zeal for the interests of science warmly shared by the officers under him. But while everything has been done to give this initiative voyage of the Hassler a high scientific character, it must not be forgotten that the present expedition is simply an incident in her history. The superintendent has indeed allowed me to make collections on our way, since we sail in waters where everything that lives has special value for the naturalist; but the expense of making these collections, and indeed all expenses of the scientific party not directly connected with the Coast Survey work, will be paid from private means provided by individual liberality.

I have thought it best to publish this statement in order to make it fully understood that the scientific expedition connected with this voyage is not its chief object, except so far as that expedition subserves the best interests of the Coast Survey."

The vessel sailed December fourth, and will touch first at St. Thomas Island. The steamer burns less than three tons of coal a day, and can thus run eight thousand miles on one hundred and fifty tons of coal, a remarkable saving of fuel. Professor Agassiz has taken out abundant stores for preserving specimens, and deep sea nets and hooks specially adapted for catching fish at great depths. We also publish a letter to Professor Pierce, the Superintendent of the Coast Survey, in regard to the aims of the dredging party from advanced proofs received from Professor Pierce, and published as a Bulletin of the Museum of Comparative Zoology.

We noticed in the last number of the Naturalist the instruction in science afforded to the teachers of Boston at the Hall of the Natural History Society, the means having been furnished by Mr. John Cummings; we should not forget the other efforts made to instruct the public and popularize science, under the auspices of the same vigorous institution, the means of which have been and are this year to be furnished by Mr. John A. Lowell, as trustee of the Lowell Institute Fund. The first courses were given for a nominal price of admission in the lecture-room of the Society's Museum, last year. The following is the programme of the lectures for this season:

"First course, beginning October 23, twelve lectures on Popular Geology by W. T. Brigham. A.M. Subjects—'Water as a Geological Agent; Chemical and Physical Properties of Water; Dew and Rains; Springs; Rivers; Waterfalls; Bogs and Marshes; Lacustine and Oceanic Deposits; The Ocean; Caverns; Snow and Ice; Glaciers; Deluges.'

Second Course, beginning December 4, six lectures by B. Joy Jeffries, M.D. Subject—'Comparative Anatomy of the Eye, and Vision.'

Third Course, beginning December 26, ten lectures by Professor G. L. Goodale, of Bowdoin College. Subject—'Physiological Botany, a study of some of the relations of Plants to Heat, Light, Electricity and Chemistry.'

Fourth Course, beginning January 29, six lectures by Thomas Dwight, Jr., M.D., Subject—'Preservation of Life among the Vertebrates.'

Fifth Course, beginning February 19, six lectures by W. G. Farlow, M. D. Subject—'Cryptogamic Botany, with special reference to the Algæ.'

Sixth Course, beginning March 11, by F. G. Sanborn, Subject,—'Talks about Insects.'"

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THE MOUNTAINS OF COLORADO.*

BY J. W. FOSTER, LL.D.

Topographical Features.— The mountains of Colorado form, perhaps, the most striking feature in the orology of the United States. Regarding the several ranges which traverse the region between Mexico on the south and the British Possessions on the north as parts of one stupendous whole, whose upheaval in the main may be referred to one geological epoch, we find that along the fortieth parallel the most active telluric forces were exerted, producing the widest expansion and culminating in the loftiest peaks. Between the Sierra Nevada on the west and the Wasatch on the east, the ridges, with their intervening valleys, reach an expansion of not less than a thousand miles. Traced north and south they not only diminish in height but contract in width to about four hundred miles. There are five or six peaks in Western Colorado which attain an altitude of over fourteen thousand feet above the sea, constituting the highest ground in the United States, with the exception of a region on the head waters of Kern River where there is a single point, Mt. Whitney, estimated at fifteen thousand feet.

Between the Missouri River and the Rocky Mountains there is a great swelling of the land, which to the ordinary observer is al-

*Read before the Chicago Academy of Sciences, November 14, 1871.

most imperceptible. Kansas City, at the junction of the Missouri and Kaw Rivers, is six hundred and forty-eight feet above tide water; First View, near the western line of Kansas, is four thousand, four hundred and seventy-nine feet; and Denver, fourteen miles from the base of the mountains, is five thousand, one hundred and five feet. Thus it will be seen that the traveller along this route is ascending a rapidly-inclined grade which to the eye appears as a dead-level.

From this elevated plateau the mountains rise abruptly, like a great rampart, ridge succeeding ridge, until, on the fortieth parallel, the culminating point is attained at Gray's Peak. This peak was named in honor of the distinguished botanist of that name, by one of his devoted disciples, Dr. Parry, who was the first to measure its altitude, which he found to be fourteen thousand, two hundred and forty-five feet.

There are really two culminating points to the range in this vicinity; one with a rounded outline probably a few feet lower, and the other cone-like in form, which in the distance resembles an aërial pyramid. It would not be inappropriate to attach to the southern point the name of Torrey, who has done so much in determining the botany of the mountain region of the United States; thus linking together the names of two honored observers who throughout a series of years have worked side by side in a common science. Here is the water-shed of the continent. The rains which fall on the western slope find their way to the Pacific through the Colorado River and the Gulf of California, and those which fall on the eastern slope reach the Atlantic through the Platte branch of the Missouri, thence through the Mississippi and the Gulf of Mexico.

Standing at Denver on a clear summer's day, the observer comprehends in the range of his vision, a view rarely surpassed in grandeur and extent. The mountains rise abruptly from the plains like a great wall which can be traced for one hundred and fifty miles. To the south is seen Pike's Peak, distant sixty miles or more, jutting into the plains, and to the north, nearly equidistant, Long's Peak, with its snow-clad flanks and bare scalp, looms up amidst the congeries of peaks. The intermediate distance is filled in with mountains of every variety of contour; some serrated, some crater-like, some pyramidal and some with rounded outlines.

The best time to view this landscape is at early morn. The mountains then resemble a great cloud-bank hanging on the verge of the western horizon. As the sun comes up illuminating the peaks and projecting crags, the landscape resolves itself into definite outlines. Over the whole are thrown broad masses of light and shade, and rock and tree and grassy slope are revealed with wonderful distinctness, while from the snow-fields are flashed back the tints of sapphire and gold. Bathed in that rare and clear atmosphere there is something in this scene ideal, unearthly. "The Delectable Mountains" revealed to the vision of John Bunyan were not comparable in grandeur to these.

While in the distance, the mountains appear to present an impenetrable barrier, yet when approached, they are found to be intersected by numerous cañons which afford practicable routes to their very heart, and enable the explorer, without exhausting effort, to scale their loftiest summits. Their arrangement *en echelon* affords passes which may be surmounted even by railroads.

We have, very properly, incorporated into our vocabulary the Spanish term "cañon" as expressive of a torrent-stream walled in by mountains. Such is the character of all the streams which descend to the plains. Rock-bedded and often rock-walled, they rush and roar in their onward course, and only find repose after their escape to the broad undulating plains.

Ascending a summit from which a bird's eye view of the country can be obtained, the contour of the surface appears like a confused mass of matter thrown up and corrugated when the elements of fire were in the wildest commotion. A tumultuous sea, instantaneously arrested and petrified, would be a miniature representation of what is here seen; and yet, when the geologist comes to carefully examine the structure of the mountains stratigraphically, he finds that they range in nearly conforming lines, whose direction is N. N. W. and S. S. E.

Another striking feature in the topography of this region is the series of high table-lands known as "parks." They are verdant valleys walled in by snowy mountains. The melting snows give rise to numerous springs and rivulets which sustain an almost perennial growth of bunch grass, making these parks according to Fremont "the paradise of all grazing animals," and these streams the favorite abode of the speckled trout. The antelope, the elk, the mountain sheep and the black-tailed deer still abound

in these rich pastures, but the buffalo has been driven away. When, in 1844, Fremont visited the South Park, herds of these animals blackened the surface, and their well-beaten trails afforded the most practicable route through the region; but now they do not even approach the foothills.

The Utes use these parks during the summer as cow lodges, but as winter approaches the herd is driven down to the plain.

GEOLOGY. To comprehend the geology of the Rocky Mountains, where the forces of metamorphism have been so powerfully exerted, it is necessary at the same time to study the geology of the Plains, where the strata repose nearly horizontally, and are abundantly charged with fossils. Starting at Kansas City, we first encounter the Coal Measures, which continue to Fort Riley. Here occurs a drab-colored limestone associated with marls, which is regarded as the equivalent of the Permian. Next succeeds a series of bright red and green marls, seen at Salina, which may be Triassic. Above this formation comes the Cretaceous occupying a broad zone nearly coterminous with the plains, conspicuously displayed at Ellis, Fossil Creek, and Fort Wallace. The Miocene-tertiary abuts against the foothills and extends to the east of Denver. At Golden City, the strata of this formation are tilted up vertically, thus showing that within comparatively recent times, this region has been subjected to violent displacements. It is characterized by heavy deposits of coal (lignite) which is successfully mined at Golden City, on Ralston's Creek, South Boulder and other streams descending from the mountains. The beds are from ten to fourteen feet thick—an undue expansion which would indicate that they are pockets, instead of persistent seams. The coal is bright and glossy, but crumbles on exposure to the air, and even when burned in a grate. It contains from twelve to fifteen per cent. of hygrometric moisture which must be expelled in combustion at the expense of the fixed carbon, and therefore prevents it from acquiring that concentrated heat necessary in metallurgic operations. It answers well for household purposes and for locomotives, and in such a region where wood is scarce, its economical value can hardly be over estimated.

As we enter the foothills, layers of brick-red sandstone are observed which, although destitute of fossils, Hayden is disposed to regard as Jurassic. There is also seen a drab-colored limestone,

used at Denver for building purposes, which Hayden regards as Carboniferous. Although ripple-marked, I observed no fossils. Both of these deposits are highly metamorphosed and the strata stand nearly vertical.

Next succeeds a vast series of gneissoidal rocks in which feldspar and mica are the predominant minerals. These rocks everywhere show lines of bedding, but they have been plicated, shattered and tilted up at all angles, and at the same time are cut by numerous divisional planes. The metamorphism of the mass is so complete as to have obliterated all traces of fossils and to have changed the mechanical structure of the rocks themselves. Perhaps there is no region on the continent where the action of igneous causes is displayed on so grand a scale as here.

The true granites are only seen along the axes of elevation. They play an important part in the structure of the region, constituting, as it were, its framework.

In the Rocky Mountain system is probably represented the whole assemblage of formations from the Azoic up to and including the Jurassic, but so thorough has been the processes of metamorphism, at least on the Atlantic slope, that it is impossible to recognize subordinate groups. On the western slope, Fremont long ago recognized rocks with organic remains, which he referred to the Oölite, which is a member of the Jurassic. The investigations of Whitney in California have settled this question—that it was at the close of the Jurassic epoch that this vast assemblage of formations was metamorphosed and folded into great ridges with their intervening valleys. The eruptive rocks accompanying this upheaval were for the most part granites, probably in a pasty condition, as in this association there are no traces of volcanic products.

Vein Phenomena.—It was at this time that the granites and metamorphic rocks became impregnated with the precious metals, such as gold and silver, which are found concentrated in veins and fissures. At a subsequent date—during the earlier Tertiary Period—a series of volcanic vents were formed along the line of previous disturbance, from which were poured forth a series of igneous products, such as basalts, lavas, etc. These also became impregnated with the precious metals, of which the famous Comstock lode in Nevada, as shown by Richthofen, is a notable example. Thus,

then, the formation of the mineral veins of this region may be referred to two distinct epochs.

The veins of Colorado, thus far mined, belong to the older class. The gold-bearing veins, unlike those of California, contain in their gangues, copper and iron pyrites, blende and galena, and so intimately is the gold connected with these sulphurets, that great loss is incurred in its extraction.

The veins of silver have, also, their associations of base sulphurets, and the silver itself appears under the forms of sulphuret and antimonial. Black Hawk and Central City are the main sites of gold mining, while Georgetown is the focus of silver mining. The annual product in the precious metals as estimated by Clarence King is about three million, two hundred and fifty thousand dollars. As constituting a part of the volcanic phenomena, may be mentioned the frequent occurrence of hot springs throughout the whole area occupied by this mountain system. In Colorado, the most noted are those of Middle Park and Idaho. The former are not readily accessible, and I am not aware that their waters have been subjected to analysis. The latter are now resorted to for their remedial virtues in cases of rheumatism, paralysis, and cutaneous affections. These springs issue from the left bank of Soda Creek, and are three in number. The flow is not copious, being about ten gallons a minute. The temperature is 109° F. An analysis of the water by Mr. J. G. Pohle of New York, gave one hundred and seven grains of solid matter to the gallon, made up of the following ingredients:

Carbonate of Soda,	30.80
Carbonate of Lime,	9.52
Carbonate of Magnesia,	2.88
Carbonate of Iron,	4.12
Sulphate of Soda,	29.36
Sulphate of Magnesia,	18.72
Sulphate of Lime,	3.44
Chloride of Sodium,	4.16
Chloride of Calcium and Magnesium, of each a trace,	
Silicate of Soda,	4.08
	107.08

CLIMATE.—One of the most striking peculiarities of these mountains is the absence of a perpetual line of congelation. Mr. Bowles in his little work on this region, calls special attention to this significant fact, and points out the diversities between these mountains and those of Switzerland; and what I propose to state under

this head will be but an amplification of this train of thought. It is true that in midsummer even large snow-fields are to be seen, but it is the result of the winter's accumulation in the ravines and other places sheltered from the sun. Above the snow-patches the grasses thrive and the delicate lichens in thin flat crusts adhere to the rocks which form the dominating peaks. The tree-line ascends to eleven thousand feet. Potatoes, beets and cabbages and the hardier cerealia, such as oats and barley, are successfully cultivated at nine thousand feet; at ten thousand feet flowers bloom, often sending forth their petals close by a snow-bank. Thus January and May are commingled. Thriving under such conditions is a wild columbine which clusters in large patches and bears a deep purple blossom fringed with white. This profusion of gaudy flowers arrested the attention even of the untutored savage, and the Utes gave to the plant the name of *idaho* or purple flower. The white explorers applied this name to a town, which they founded on the banks of Clear Creek in Colorado, and a band of miners swarming thence to a region farther north, carried with them this name, which subsequently became attached to a territory of the United States.

During the summer, day after day, the sun comes up without a cloud; but midday passed, there is an afternoon mist, often accompanied by thunder and lightning. At Denver the phenomena of gusts of wind and thunder and lightning are of almost daily occurrence, and yet without a drop of rain. During the month of July last, the precipitation was fifty-one one-hundreths of an inch. In the mountains there are " cloud bursts," when the rains fall in a cataract and filling the gulches sweep every thing before them.

The electrical phenomena often occurring during a storm on the summits of the mountains are most vivid, and dangerous to those caught in such exposed positions. There are authentic instances where the body becomes so surcharged with electricity that the hair stands out rigidly, and sparks are emitted from the person thus isolated when approached, and every metallic article becomes luminous.

Statistics as to the amount of rainfall in the montains have not been collected, but at Denver it only reaches about thirteen inches during the year.

In that dry and bracing atmosphere the thermometer may rise to ninety degrees F. and yet without producing those depressing

effects experienced in a more humid climate. Perspiration is almost insensible. The residents represent that autumn is the pleasantest portion of the year, and that this delicious season continues until January, when the winter seriously sets in and continues until May. The snows are not deep, and on the cliffs exposed to the direct rays of the sun rarely remain over a few days. Such is the climate in the cañons, but on the higher peaks a mantle of white begins to form late in September and continues to accumulate until spring.

The temperature at Denver, two thousand, one hundred and five feet above the sea, does not differ essentially from that at Cambridge, Massachusetts, seventy-one feet above the sea, while the difference of latitude is about two degrees. This is shown in the subjoined table:

	Spr.	Sum.	Aut.	Win.	Mean.
DENVER.	45.6	69.0	39.9	30.3	46.2
CAMBRIDGE.	44.3	68.6	50.1	26.2	47.3
	1.3+	.4—	10.2—	4.1+	1.1—

Mt. Washington, in New Hampshire, is six thousand six hundred feet above the sea, and the little band of observers who last year passed the winter upon its summit, encountered all the rigors of an arctic climate. At Idaho Springs, in the heart of the Colorado Mountains, and one thousand one hundred and forty-two feet higher, cattle may pass the winter without shelter. A warm breath permeates the valleys, mitigating the severity of winter, and rendering the climate agreeable to the human system. I will not pause to discuss the causes of this anomaly, so at variance with what is observed in other regions lying within the temperate zone.

If we turn to the Alps, from which we naturally derive our ideas of the effects of temperature by reason of elevation, we shall find that far different conditions prevail. At the height of eight thousand feet the line of perpetual snow is encountered, and not less than four hundred glaciers exist, extending over an area of fourteen hundred square miles. Mt. Blanc, fifteen thousand, seven hundred and forty-four feet above the sea, about fifteen hundred feet higher than several of the Colorado Peaks, is scaled only by cut-

ting steps for a long distance in an icy acclivity, and its scalp is always snow-clad. The pines and larches disappear at five thousand, nine hundred feet, while the mosses and lichens continue up to the line of perpetual snow. The cerealia are not grown higher than three thousand, eight hundred, or four thousand feet, but in one sheltered place, Skala, barley ripens at five thousand, nine hundred and fifty feet above the sea.

In order to produce glaciers there must be a marked relief and depression of the surface and a marked vicissitude between the summer and winter temperature. While the Andes in the tropics rise into the region of perpetual congelation, there is not that variation of temperature which is necessary to produce *nevè*, that aggregation of large crystalline facets, so different from river-ice, which make up glaciers. Many parts of Siberia and North America are within the line of permanent ground frost, and yet no glaciers are formed. In the Alps, according to Forbes, the summer's thaw percolates the snow to a great depth with water. The frost of the succeeding winter penetrates it far enough to freeze it to at least the thickness of one year's fall; or by being repeated in two or more years, consolidates it more effectually. The glacier commences near the line of perpetual snow, and renewed by the accumulation of each winter descends to a lower level, its extremity being constantly dissolved by the summer's heat.

In the Colorado region the conditions of relief and depression of surface are sufficient to maintain glaciers, but the temperature is not sufficiently low to maintain a line of perpetual congelation on which they depend for their existence.

Glacial Action.—Two enquiries naturally suggest themselves; were these mountains formerly encased in ice? Were these plains subjected to that erosive action so conspicuously displayed in New England and the region of the Great Lakes?

The western limit of the Erratic block group, as observed by me, is in the immediate valley of the Missouri, between Leavenworth and Lawrence. The western limit of the striated rocks, as observed by Hayden, is at Plattsmouth, also in the immediate valley of the Missouri.

In crossing the plains, which expand to more than six hundred miles in width, there is an absence of all drift phenomena, such as boulders, gravel knolls, and planed surfaces, until Denver

is approached. Here the soil reposes on a water-washed gravel, but the beds of the streams are composed of shifting sands. Advancing towards the foothills, small boulders are observed strown over the surface, and occasionally it is traversed by ridges of sand.

In fact the observer experiences a feeling of disappointment at the absence of the more striking drift phenomena; for naturally comparing this region with the Alps, he expects to see great outlying masses of rock which have been transported far from the parent bed; accumulations of gravel and sand in the nature of terminal moraines; and rock surfaces which have been planed down and striated. Entering the mountains, the cliffs are jagged, no where exhibiting those smooth outlines seen in the Alps and called by De Saussure, *roches moutonnées*. The enclosing banks of the streams are made up of large egg-shaped pebbles and occasional boulders two and three feet in diameter. None of these materials, so far as I have observed, are *striated*, while the true drift pebbles are almost invariably marked by such signs. Taking Clear Creek as the line of my observation, these water-worn materials do not attain an elevation above its bed of more than one hundred feet, and tracing the smaller streams to higher elevations they soon disappear and are replaced by angular fragments.

The transporting power of the present streams is very great. They have a descent of from fifty to one hundred feet to the mile, and, swollen by the spring freshets, the waters sweep down with sufficient force to bear along the largest boulders here observed, particularly if entangled in ice.

Another phenomenon characteristic of all true drift regions, is entirely wanting on the plains, and but sparingly represented in the mountains; and that is the absence of lakes. Professor Ramsey, as far back as 1862, in a paper communicated to the Geological Society of London, pointed out the fact that lakes were very numerous in those regions where the evidences of ice action were most manifest, and comparatively rare in tropical and subtropical regions; and maintained that they were actually due to the erosion of their basins by glaciers.

The scenery of the Alps derives one of its principal charms from the abundance of its lakes. We may refer to Geneva, Constance and Zurich, near the borders of the mountains, to the Lakes of the Four Cantons, Lago Maggiore, and Como, and the

series of Austrian lakes, to say nothing of the innumerable pools of water which occur near the summits of the loftier ridges.

The scenery of Sweden and Norway is diversified by these inland enclosures of water, which become rare in the more temperate climates.

If we consult a map of the northern portion of our own country, we shall find that, leaving out the great chain of the Canadian Lakes, and such collections of water as Winnepeg, Athabasca, Slave Lake and Bear Lake, all the way from Minnesota to the Arctic Sea, there are innumerable smaller lakes which enable the voyageur in his canoe to penetrate to every portion of the country. In southern Wisconsin the lakes are few and in Illinois they disappear almost altogether.

On the plains there is not a permanent collection of water to which we attach the name of lake; and in the mountains they are rare. This is the more surprising when we consider how actively the forces of elevation and subsidence have been exerted. The Great Basin, it is true, is characterized by numerous lakes, most of which are of a highly saline or brackish character, but in a region where the streams are cut off from the sea, it is but natural that the waters should accumulate in the depressions.

There may have been a time when the annual precipitation of rain was greater, and consequently the transporting power of the streams was increased beyond their present capacity, but there are few phenomena with regard to the distribution of the superficial materials which cannot be explained by a resort to causes now in operation. Professor Whitney has arrived at substantially the same results with regard to the Pacific slope.

In concluding these observations, I may remark that the railroad facilities are now so far developed that to an inhabitant of the Mississippi Valley, this region is as accessible as the White Mountains of New England. The ordinary observer is brought in contact with some of the grandest scenes in nature, whilst to the geologist and botanist are opened new spheres of observation — a constantly recurring succession of the most interesting and varied phenomena.

IRRIGATION AND THE FLORA OF THE PLAINS.

BY E. L. GREENE.

The system of irrigation is destined to effect some interesting changes in the aspect of the western plains in regard to their botany, as will appear from a few facts which we subjoin as the result of observations made in Colorado during the past two seasons.

It might be expected that refreshing streams conducted through this naturally rich, but extremely arid soil, would have flowery banks. So indeed it does sometimes happen, and so it would always be if the diggers of ditches would make them broad and shallow, with gradually sloping banks, instead of digging them narrow and deep and leaving the sides perpendicular.

God speed the labors of the "grim utilitarian;" for when he has plowed, and scattered the "precious seed," we know that with the wheat, there will spring up and bloom the purple corn cockle, and the yellow evening primrose—one joy for him and three for us. Or, if his skill divides the mountain stream, causing a portion of its waters to turn from their natural course adown the valley, and leads them over the thirsty plains that lie above, the happier are we; for while now from the face of the "desert" he reaps golden harvests, we see it "rejoice and blossom as the rose."

We will suppose that the reader is a botanist, and that he has come out from the far Atlantic shore, to pass a few summer weeks among the mountains. Arrived in Denver, the next point to be gained is Golden City, the gateway to the mountains. He might traverse this short distance in less than a half hour by rail, but of this mode of conveyance, excellent as it is, some three thousand miles, more or less, he is now doubtless tired; besides, he wishes to see something of the vegetation of the plains before leaving them for the rocks and the pine-forests, the alpine bogs, and the fields of perpetual snow. You then take this little trip to Golden City on foot. It is July or August. There has been no rain for these many weeks. The road is miserably dusty, but if you are on foot (or on horseback) you need not follow it, and the whole

surface of the plains is sere and brown save some "eighties" or larger tracts that are fenced, and under cultivation.

You have perhaps crossed a broad, deep canal of swiftly-flowing, muddy water, and now in passing these fields of grain you hear the laughing voices of little streams. They are hidden from view by the standing growth, and at proper distances from each other they go, singing on their way across the gently sloping fields, making glad the hearts of the ranchmen, with their sure promises of an abundant harvest. Now right in the midst of one of these "eighties" of wheat, you behold a solid-half-acre of—*can it be?* Yes, those are certainly the long strap-shaped leaves, and the dark cylindrical spikes of *Typha latifolia!* the veritable Cat-tail Flag; and growing more densely and luxuriantly than you ever saw it before.

It is difficult to harmonize, in your mind, this patch of marsh with its close surrounding of thrifty grain, and equally difficult is it to reconcile the whole field with what seems to shut it in on all sides *i. e.* a seeming boundless, lifeless waste of withered prairie grass. There are now, on these plains, many acres of Cat-tail Flag where five years ago, no seed of a marsh plant would have germinated, because all was then more like an African desert than an American swamp. The change came after the following manner. The large ditch was first made from some stream before it leaves the mountains, and led along the higher ground, whence its waters were conducted to these lands below, which now constitute fertile fields. After one or two seasons of irrigation, all slight hollows came to be occupied by shallow ponds. Why the surplus waters do not sink away into the earth beneath, you must learn from the geologist. The fact is they do not. Even during fall and winter when the water is turned off from the ditches, the ponds remain the same, the water in them falling but slightly below the ordinary level.

The gossamer-winged seeds of the Typha are borne upon the winds by the thousand, from the valleys of the rivers below, to these uplands. Here they find all circumstances favorable to germination, and the plants grow and spread rapidly; sedges and other marsh plants growing with them, and the whole comes in the course of a few years to bear a strong contrast to the almost desert tracts around.

In the settled, and consequently irrigated, portions of country

which lie nearest the foothills, where the landscape is considerably varied by elevations and depressions, there are now many larger lakes covering five or ten acres and quite deep, which were nothing more than dry hollows six or eight years ago. The number and variety of aquatic plants in these lakes are increasing every year, and on the shores of some the cotton woods and willows that have sprung up from seed are becoming quite conspicuous. In the section of which I speak, there are no natural lakes or ponds, but in those which have been the incidental result of the irrigation of the lands around them, the water-fowl, the amphibious reptiles, and strictly aquatic plants have all found for themselves homes in what was but a dry waste, a few years since. Some of the very oldest lines of ditches are now noticeable, at great distances by the native willows, which have sprung from seed and attained their full size, all along their banks. Otherwise the willows and cotton woods grow only in the mountains or by the rivers whose valleys lie considerably below the level of the plains.

Among the plants of the plains are a large class of annuals, the seeds of which seem invariably to germinate in autumn, and the plants, to attain half their growth during the fall and early winter, so that they flower in April and May. These are for the most part gone out of flower before the first of June, in all the uncultivated portions of the country; and during all the burning months of summer the seeds lie waiting for the rains of early autumn to start them into life. But not so upon the cultivated lands. Here, wherever moisture is given, there is a regular succession of these plants in bloom, through the whole summer and fall; and by the ditches at the side of our village streets, the botanist may in October gather excellent specimens of plants, which, before the settlement of the country, he would have found nowhere after May. The same may be said of many perennials, which, in the vicinity of the water, continue to send forth fresh stems and flowers, long after their season is past in other places.

THE FORMER RANGE OF THE BUFFALO.

BY JOHN G. HENDERSON.

COMPARATIVELY speaking it will be but a short time until the buffalo, like the great Irish elk, the mastodon, the dodo, and other extinct animals, that have lived since the appearance of man upon the earth, will only be known to us by its bones, with this advantage, however, over the mastodon; its character, habits and territory over which it formerly ranged are all accurately described by the historian and naturalist, as well as the causes which are leading to its extinction. As civilized man advances, the buffalo, the elk, the deer, the beaver, the otter, the bear, the panther, the wild-cat and wolf, and other members of the wilderness or prairie fauna, must give way to domesticated animals—animals whose original wildness and savageness have been subdued, and whose whole organization, mental and physical, has been by thousands of years of contact with civilized man modified and changed so as to become subservient to his wishes and purposes. Some, as the buffalo, elk and deer, are slaughtered for their flesh and hides; others as the otter and the beaver, for their skins alone; while still others, such as the panther, wild cat and wolf, are killed on account of their savageness, their existence being incompatible with the presence of civilized man.

For the buffalo are substituted our common cattle, for the wolf and wild cat, our domesticated dog and cat. Instead of clothing himself with the skins of the buffalo and deer, and living upon the fruits of the chase, the civilized man carries with him the sheep, from whose fleece he makes his coat for winter; or rears the cotton plant, while from its fibres he manufactures his fabrics, instead of fraying the inner bark of the cedar or basswood for the same purpose, as did the aboriginal man.

But civilized man in his march into the wilderness, or in his advance upon the prairies, meets with many new forms of animal life and from their number he now and then selects some, such as the wild turkey, for example, which seems to have a pre-adaptation to domestication, and from such he adds to the stock of his domesticated species.

But the advent of civilized man not only disturbs the native fauna by the extermination of large numbers of animals, but also by causing others to increase largely in numbers. When the enemy of any animal is exterminated or thinned out by any cause, such animal will rapidly increase in numbers. For illustration, the enemies of the smaller birds — the larger birds of prey — are destroyed by civilized man. This gives the small birds an advantage in the struggle for existence and they increase in numbers. It will thus be seen that the real amount of disturbance of the native fauna of the prairie or wilderness is not so easily comprehended as one would at first imagine.

The early Jesuit missionaries and French *voyageurs*, who by the way of the Great Lakes penetrated to the valley of the Mississippi, at the end of the seventeenth century, found the buffalo in thousands grazing upon the prairies of Illinois and neighboring states, or flying in countless numbers before the Red-hunter, or the prairie fire.

The idea of their domestication at once entered their heads, and, from that time to the present, many attempts have been made to domesticate them, or, by crossing with domesticated cattle, to impart to the latter some additional valuable quality; but I believe that hitherto all such attempts have proven abortive. Now and then, upon the western frontier, you may see the dun color, high shoulders, and somewhat restless disposition, that indicate a cross between the domestic cow and buffalo bull, but, like the red-blood of the Indian, the mighty throng that is pressing on, soon absorbs it, and obliterates effectually its marks, if not wholly its effects.

It was with a peculiar interest that I read the descriptions of these strange animals, transmitted home by the Jesuit or *voyageur*, who two hundred years ago first looked upon "our vast prairies on which herds of *wild-cattle* pastured in confusion." Strange contrast! Where now iron rails mark the highway of civilization and commerce, then were only paths made by the buffalo, or the Indian trail to hunting grounds or from village to village. Where now are great cities, built of brick, stone and iron, with their iron and marble fronted palaces of trade, then were Indian villages of sometimes five hundred cabins made of rushes sewed together by the hands of industrious squaws so ingeniously as to render them impervious to rain and snow, and so light

as to render it easy for the Indian woman to obey her dusky master when he ordered her to "take up her house and walk." Now huge boats, with gilded saloons propelled by powerful steam engines float on the bosoms of our rivers, then the light canoe made of the cotton wood log by the use of the fire and stone ax, or the still lighter birch-bark, were the only keels that had ever disturbed their waters.

As the sources of information of this character are not accessible to many readers of the NATURALIST, I may be pardoned for freely transcribing from accounts given in Jesuit letters and *Relations*, and from the pages of early French writers and *voyageurs*. Here we see old Illinois — as it was at the end of the seventeenth century — the otter, beaver, and wigwams upon the banks of its rivers, the panthers, wolves, bears and wild-cats in its forests, with its great prairies of wild grass where grazed the deer, the elk, and the buffalo, or at noon-tide shielded themselves from the summer's sun under the shade of lonely cotton wood trees, or in the beautiful groves that here and there studded the plain, like islands upon the bosom of the ocean. Here, too, we see primitive man hollowing out his boat by the aid of fire and the stone ax, skinning animals and dressing their hides with the flint knife, and engaged in war or the chase, armed with the war-club and bow, and whose arrows were tipped with bone or flint. Here are presented to our view the first effects of the contact of civilization and barbarism, we see the Indian eagerly exchanging skins of the buffalo and beaver, and other articles demanded by civilization, for the iron ax, knife, gun, and kettle, to supply the place of the stone ax, flint knife, bow and arrow, and Indian *akeek*. Here we see the gay and volatile French associating upon terms of equality with the Indian, each adopting the manners and habits of the other and thus assimilating the habits of civilized man with the superstitions and customs of the savage, for the "Frenchman forgot not that the uncivilized man as well as the civilized man, was his brother and he deported himself as man to man." Here we see the Jesuit, the medicine-man of civilization, struggling to displace the superstitious rites and ceremonies of the medicine-man of the forest, to substitute his own no less whimsical, foolish and absurd rites and ceremonies in their stead; and the triumph of the former, when, as on one occasion, after forty dogs had been sacrificed to appease the spirit of destruction,

which, in the form of disease, was laying waste the village, the medicine-man was forced to bow his knee to the cross and offer up his prayer for mercy to the great Manitou of the French. Here in these old Jesuit *Relations* and Letters we see the Red-man on bended knee before the blessed virgin, reciting the rosary or repeating *Ave Marias* translated into the Algonquin language by the Jesuit fathers.

The Jesuit missionary, Father Marquette, who, with Joliet and five French *voyageurs*, discovered and explored the Upper Mississippi, in the year 1673, was the first white man who penetrated to the habitat of the buffalo, by way of the Great Lakes. Father Claude Alloüez and other missionaries, who had penetrated the wilderness as far as *Che-goi-me-gon*, a great Chippewa Village at the extreme west end of Lake Superior, no doubt had heard from the wandering Sioux, or as they were known in those days, the Nadouessi, of the great plains that lay farther westward and of the vast herds of buffaloes that roamed over them. History, indeed, records the fact, that these Sioux Indians told the strange pale-faces that came among them with "pictures of hell and of the last judgment" of their manner of shielding themselves from the winter's storm with the hides of wild-cattle for the roof of their cabins instead of bark. It was here, too, that the missionaries heard of the Great River, and here, for the first time in history, appear those two Algonquin words, *Messi-Sepe*. Father Alloüez, in speaking of the Sioux Indians says, "They live on the great river called Messipi." He blended the adjective *Messi*, great, and the noun *Sepe*, river, into the word *Messipi*, which was no greater corruption of the original than our Missis-sippi. It was here, too, that Father Marquette received tidings of the Great River, and the nations that dwelt upon its banks, and it was here that he resolved to explore it. "This great river," he says, "can hardly empty in Virginia, and we believe that its mouth is in California. If the Indians who promise to make me a canoe do not fail to keep their word, we shall go into this river as soon as we can with a Frenchman and this young man given me, who knows some of these languages, and has a readiness for learning others; we shall visit the nations which inhabit it, in order to open the way to so many of our fathers who have long awaited this happiness." *

At the same Chippewa Village, the Jesuits met the *Illinois* Indi-

* Marquette's Letter to Le Mercier.

ans, who came there to rehearse their sorrows and ask the protection of the French. The Sioux upon the one side and the Iroquois upon the other, had made savage inroads upon them. They told of the noble river upon which they dwelt. "They had no forests, but instead of them, vast prairies where herds of deer and buffalo, and other animals, grazed on the tall grasses." This is the first mention that is made of the buffalo upon the prairies of Illinois. None of the French had yet seen the buffalo unless, perchance, some trader had followed the Indians to their hunting grounds, though many thousands of robes had already been transported from the region of the Upper Mississippi to Europe. They were taken from the buffaloes by Indian hunters, tanned and prepared by the hands of the squaws, and then in birch-bark canoes, transported by way of the western rivers to the *portages*, where canoe and cargo were carried across to the head waters of rivers that emptied into the Great Lakes, over whose waters, still in the birch-bark canoe, they were carried to Quebec, and there by their Indian owners, exchanged for articles of French manufacture suitable to the wants of savage man.

Father Marquette says of the Illinois, "They always come by land. They sow maize which they have in great plenty; they have pumpkins as large as those of France, aud plenty of roots and fruit. The chase is very abundant in wild-cattle, bears, stags, turkeys, duck, bustard, wild-pigeon and cranes. They leave their towns at certain times every year to go to their hunting grounds together, so as to be better able to resist if attacked. They believe that I will spread peace every where, if I go, and then only the young will go to hunt."*

It was not, however, until the fall of the year 1672 that he received orders from his superiors "which bid him embark at last upon the voyage so long and fondly projected."

Louis Joliet, whose name is now imperishably connected with that of Marquette in the discovery of the Mississippi River, arrived in the spring of 1673, with orders, from Comte de Frontenac, governor of Canada, and M. Talon the intendant, for the exploration of the great river.

Thé winter before the arrival of Joliet was spent in busy preparation for the great voyage. From the wandering Indians Father Marquette gathered all the information he could, and from their

* Ibid.

statements he drew the first rude map of the Great River, and marked upon it the names of the nations that dwelt upon its borders. He says "as we were going to seek unknown countries, we took all possible precautions, that if our enterprise was hazardous it should not be fool-hardy; for this reason we gathered all possible information from Indians, who had frequented those parts, and even from their accounts traced a map of all the new country, marking down the rivers on which we were to sail, the names of the nations and places through which we were to pass, the course of the great river, and what direction we should take when we got to it." *

It was on the 17th of May, 1673, that they started from the mission of St. Ignatius at Michilimakinak, and "made their paddles play merrily over Lake Huron and that of the Illinois (Lake Michigan) into the bay of the Fetid (Green Bay)." Here they met the Wild-Oat Indians, or, as they are called in French, the *Folles-Avoines*, a nation that dwelt upon the borders of the bay and the Menomonee River. Marquette informed them of his intended voyage, at which they were much surprised. They tried to dissuade him from the undertaking by telling him of hostile nations that dwelt upon the borders of the *Messi-Sepe*, whose scalping knives were never sheathed and who never spared strangers, but tomahawked them without any provocation; they told him of war-parties constantly in the field; that the Great River was very dangerous, unless the difficult parts were known; that it was full of frightful monsters who swallowed up men and canoes together; that there was a demon there who could be heard from afar, who stopped the passage and engulfed all who dared to approach; and finally, they told him of heat that was so excessive in those countries, that it would infallibly cause their death.

The zealous missionary thanked them for their good advice, and told them that he would only be too happy to lay down his life for the salvation of souls. They entered Fox River, of which Marquette says: "it is very beautiful at its mouth, and flows gently; it is full of bustards, duck, teal, and other birds attracted by the wild-oats,† of which they are very fond." On the 7th of June they arrived at a village of the Mascoutins, where they found three nations—the Miamis, the Maskoutens and Kikabous, living in

*Journal of Father Marquette.

† The *Zizania aquatica* Linn.

cabins made of rushes. Father Marquette was enraptured in beholding the position of their town, "the view was beautiful and very picturesque, for from the eminence on which it was perched, the eye discovered on every side prairies spreading away beyond its reach, interspersed with thickets or groves of lofty trees." After having assembled the Indians and addressing them upon the objects of their voyage, and after having received a present from the Indians, a mat which served them as a bed, they set out upon their voyage. They embarked in the "sight of a great crowd, who could not wonder enough to see seven Frenchmen alone in two canoes dare to undertake so strange and hazardous an expedition."

With the assistance of two Miami Indians, given them as guides, they found their way through the marshes to the "*portage*" where canoes and cargoes were carried and safely deposited in the Wisconsin. Here they bid good-by to the waters that flowed through the Great Lakes and the St. Lawrence by Quebec, and turned to follow those that were to lead them into strange lands. They bid their Indian guides good-by, and the *voyageurs* "were alone in an unknown country in the hands of Providence." They floated silently down the Wisconsin. "It was an unbroken solitude, where the ripple of their paddles sounded loudly on the ear, and their voices, subdued by the stillness, were sent back in lonely echoes from the shore." *

They "saw no small game or fish, but deer and elk in considerable numbers." Bancroft renders the word *vaches*, buffalo, but this is a mistake. They had not yet reached the buffalo ground. The words *vache sauvage*, as used by the Canadian French, applied to the American elk, *Cervus Canadensis*.†

At length, on the 17th day of June, with a joy that Marquette could find no words to express, they glided into the Great River, the storied theme of many an Indian tale. They gently followed its course to the forty-second degree of latitude. Here all was changed. Their birch-bark canoes were now floating between the great prairies of Iowa and Illinois, while the river was studded with beautiful islands fringed with willows whose branches were reflected back from the bosom of the water. Everything was strange and calculated to strike the imagination of the *voyageurs*. At one time a great fish struck one of the canoes so violently that

* McConnel; *Western Characters*, p. 88.

† *Discovery and Ex. of the Miss.*, J. G. Shea, p. 16.

they thought it would break the canoe in pieces; at another, they saw a monstrous animal swimming across the river.* And thus they floated on until they arrived at the home of the buffalo.

"Having descended as far south as 41° 28′," Marquette says, "we find that turkeys have taken the place of game, and *Pisikious*, † or wild cattle, that of other beasts. We call them wild cattle because they are like our domestic cattle; they are not longer but almost as big again, and more corpulent; our men having killed one, three of us had considerable trouble in moving it. The head is very large, the forehead flat and a foot and a half between the horns, which are exactly like those of our cattle, except that they are black and much larger. Under the neck there is a kind of large crop hanging down, and on the back a pretty high hump. The whole head, the neck and part of the shoulders are covered with a great mane like a horse's; it is a crest a foot long, which renders them hideous, and falling over their eyes, prevents their seeing before them. The rest of the body is covered with a coarse, curly hair like the wool of our sheep, but much stronger and thicker. It falls in summer and the skin is then as soft as velvet. At this time the Indians employ the skins to make beautiful robes, which they paint of various colors; the flesh and fat of the *Pisikious* are excellent and constitute the best dish in banquets. They are very fierce and not a year passes without their killing some Indian. When attacked, they take a man with their horns, if they can, lift him up, and then dashing him on the ground, trample on him and kill him. When you fire at them from a distance with gun or bow, you must throw yourself upon the ground as soon as you fire, and hide in the grass; for if they perceive the one who fired they rush on him and attack him.‡ As their feet are large and rather short, they do not generally go very fast, except when they are irritated. They are scattered over the prairies like herds of cattle. I have seen a band of four hundred of them."§

Thus far the exploring party had not seen a single human being; on the 25th of June, however, they saw a human track in the

*The "great fish," it is supposed, was the Mississippi cat-fish, and the "monstrous animal" either the tiger-cat or the panther.

† Algonquin name for buffalo, called also, in Indian, *Beezhike*.

‡ "When these animals are shot at a distance of fifty or sixty yards, they rarely, if ever, charge on the hunters." *Audubon and Bachman, Quadrupeds of North America*. Vol. 2, p. 44.

§ Marquette's Journal, p. 19 of J. G. Shea's *Dis. and Ex. of The Miss.*

sand. Marquette and Joliet followed it. It led to a path, and that to an Indian village. Marquette hailed the Indians in the Illinois language, and they answered, "we are Illinois." They feasted the pale-faces upon sagamity,* fish, dog, and buffalo—the fat of the land. The master of ceremonies blew his breath upon the food to cool it, and, with spoons of buffalo horn, put three or four mouthfuls in the mouths of their guests, "as we would feed a bird." After five days of feasting, smoking and council, six hundred men, women and children escorted them to their boats, and, after promising to return to stay with them, they again committed themselves to the current of the *Messi-Sepe.* They passed by the *Piesa* paintings upon the face of a limestone cliff, of which Marquette gives a description, and while conversing about them, they heard the rushing of the waters of the Missouri, known to them by its Algonquin name of *Pekitanoui*, or Muddy River. Swollen by the melting of snows a thousand miles away in the mountains, it was pouring its impetuous current into that of the Mississippi, freighted with large trees, branches and drift wood, "real floating islands," says Marquette. He speaks of the mouth of the Ohio River, then known as the *Ouabonkigou*, which we have corrupted into *Wabash*, and applied to a tributary of the Ohio. The word Ohio is of Iroquois origin. The original was *Oheo* or *Youghio*, and meant *beautiful.* Farther down they met other Indians who feasted them on *wild-beef.* Marquette says of them "that they did not know what a beaver was, and their riches consisted in the skins of *wild-cattle.*" He speaks of the Indians on the lower Mississippi as being armed with bucklers made of the skins of wild cattle, and says "that the number of wild cattle they heard bellowing made them believe that the prairies were near." The *voyageurs* returned about the last of August or the first of September, passing up the Illinois River. Upon its banks he again met the Peoria Indians, the same that were at Moingona. Of the country Father Marquette remarks, "we had seen nothing like this river for the fertility of the land, its prairies, woods, *wild-cattle*, stag, deer, wild-cats, bustards, swans, ducks, parrots, and even beaver; its many little lakes and rivers."†

Father Claude Allouez, in a "Narrative of a Journey to the Illinois," written shortly after Marquette's voyage, in speaking of the

* Indian meal boiled in water and seasoned with grease.

† Marquette's Journal, p. 19 of J. G. Shea's *Dis. and Ex. of the Miss.*

occupations of the Indians, says, "they hunt cattle, deer, turkeys, cats, a kind of tiger, and other animals, of which they reckon twenty-two kinds, and forty kinds of game and birds."*

The buffalo was of incalculable benefit to the Indians. Of the hoofs and horns they manufactured glue. The tallow was an article of commerce and was used for various purposes, among which was that of mixing with Indian meal to make *sagamity*. The tongue was considered a delicacy and the "jerked" beef served them for bread and meat. Of the skins the Indians made robes for beds or the floor of the cabin, or for blankets at night. Of the raw hide they cut thin strips for making snow shoes and various other purposes. The skins were used by the Sioux Indians for covering for their lodges and the modern Mandans stretch a raw buffalo hide over a wicker frame, and thus, using it as a substitute for birch bark, make a light, portable boat similar in construction to that of the coracle of the ancient Britons, or the Esquimaux *kaiak*.† They also made spoons and ladles of the horns, and, according to Marquette, the Illinois Indians used the bones for the same purpose. He says, "they made all their dishes of wood, and their spoons of the bones of the buffalo, which they cut so well that it serves them to eat their sagamity easily." The chiefs wore beautiful scarfs "ingeniously made of the hair of bears and wild oxen."

From Father Marest we learn that these scarfs were made by the women, also the mats for wigwams. In a letter dated Kaskaskia, November 9th, 1712, he says, "the chase and war are the sole occupations of the men, while the rest of the labor falls upon the women and girls. They are the persons who prepare the ground for sowing, do the cooking, pound the corn, build the wigwams, and carry them on their shoulders in their journeys. Their wigwams are constructed of mats made of platted reeds which they have the skill to sew together in such a way that the rain cannot penetrate them when they are new. Besides these things, they occupy themselves in manufacturing articles from buffalo's hair, and in making bands, belts and sacks, for the buffaloes here are very different from our cattle in Europe. Besides having a large hump on the back of the shoulders they are also entirely covered with a fine wool, which our Indians manufacture instead

*Ibid, p. 75.

†See Dr. Wilson's Prehistoric man. p. 115.

of that which they would procure from sheep, if they had them in the country." *

Father Rasles also describes the occupations of the women. "They toil like slaves from morning till night. It is their duty during summer to cultivate the earth and plant the Indian corn; and from the commencement of winter they are occupied in manufacturing mats, dressing skins, and many other works of the kind, for their first care is to provide everything that is necessary for their cabin." †

In the chase of the buffalo the Indian relied mainly upon his bow and arrow. The Indians of that period were very expert in their use. The little bow and the tiny arrow, pointed with the little flint arrow-heads found everywhere over our state, was placed in the hands of Indian boys who ranged among the hills, practising upon small birds, and "they became so skilful that at ten or twelve years of age they scarcely ever failed to kill the bird at which they aimed." ‡

Little boys of the Sioux nation, were thus early taught the use of the bow, and, also, "shot small sun-fish with a bow and an arrow, with a little spear fastened to it." § The Illinois were in the habit of shooting fish with the bow and arrow. "They embarked in a canoe with their bows and arrows; standing upright, for the purpose of more easily seeing the fish, as soon as they perceived it, they pierced it with an arrow." ‖ I have no doubt but that the Indian boys of Illinois also shot the sun-fish with the bow and arrow.

Father Marquette described the Illinois Indians as "well-formed, nimble, and very adroit in using the bow and arrow." Allouez bears testimony upon the same point, "they ordinarily carry only the war-club, bow, and quiver full of arrows, which they discharge so adroitly and quickly that men armed with guns have hardly time to raise them to their shoulders. They also carry a large buckler made of the skins of wild-cattle; which is arrow proof and covers the whole body." ¶

From Father Rasles, we learn the character of the arrows, and

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* Kip. *Early Jesuit Missions*. p. 199.
† Ibid. 38.
‡ Ibid 26.
§ *History, Condition, Prospects* etc. Schoolcraft, Vol. 4. p. 61.
‖ *Early Jesuit Missions*, Kip. p. 40.
¶ *Dis. and Ex. of Miss.* J. G. Shea, p. 75.

the skill with which they were used. "Arrows are the principal arms which they (Illinois Indians) use in war and in the chase. They are pointed at the end with a stone cut and sharpened in the shape of a serpent's tongue; and if no knife is at hand, they use them also to skin the animals they have killed. They are so skilful in using the bow, they scarcely ever fail in their aim, and they do it with so much quickness that they can discharge a hundred arrows in the time another person would use in loading a gun."*

The Indians on the lower Mississippi shot an arrow clear through the horse of De Soto, and it is said that the modern Indians on the plains, think it no unusual feat to send an arrow through a buffalo, so that it falls on the ground upon the other side, and this was doubtless done often by the Indians of the olden time upon our prairies.

Some of the descriptions given by the Jesuits of our vast prairies, with herds of buffalo and other animals grazing upon them, are charming indeed. Father Rasles in his letter above quoted, speaks of vast herds of buffaloes and roebucks, and says, "that not a single year passes but they kill more than a thousand roebucks and more than two thousand buffaloes. From four to five thousand of the latter can often be seen at one view grazing on the prairies."†

"Of all the nations of Canada, there are none who live in so great abundance of everything as the Illinois. Their rivers are covered with swans, bustards, ducks and teals. One can scarcely travel a league without finding a prodigious multitude of turkeys, who keep together in flocks, often to the number of two hundred."‡

Father Hennepin also speaks of herds of buffalo, grazing between

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* *Early Jesuit Missions* Kip. p. 39.

"†Lewis and Clark in descending the Missouri in 1806, on passing the environs upon White River, estimated that they saw twenty thousand on the prairies at one time." Schoolcraft, *Hist. Cond. Prospects, etc.*, Vol. 4, p. 93.

"Some idea of the immense numbers of bisons to be seen on the wild prairies, may be formed from the following account, given to us by Mr. Kipp, one of the principals of the American Fur Company, who, while he was travelling from Travers' Bay to the Mandan nation in the month of August in a cart heavily laden, passed through herds of buffalo for six days in succession. At another time he saw the great prairie near Fort Clark on the Missouri River, almost blackened by these animals, which covered the plain to the hills that bounded the view in all directions, and probably extended farther." *Quadrupeds of North America*, Audubon and Bachman, Vol. 2. p. 47.

These quotations are made to justify the statements as to the vast numbers of buffaloes that formerly roamed over the prairies of Illinois.

‡ Kip. *Early Jesuit Missions*, p. 39.

the bluffs and the banks of the Mississippi, or as he called it, in his journal, the river Colbert. The voyage of Hennepin down the Illinois and up the Mississippi River, was in the year 1680.* Of the scenery upon the Illinois River, called by him, the *Seignelay*, he says "it is lined with hills, whose sides are covered with fine large trees. Some of these hills are half a league apart, leaving between them a marshy strip often inundated, especially in the spring and fall, but producing, nevertheless, quite large trees. On ascending these hills, you discover prairies further than the eye can reach, studded at intervals with groves of tall trees, apparently planted there intentionally."

Father Membre, in his narrative of the voyage of La Salle (1682) gives a glowing and poetical account of the beauty of the country He speaks of the Illinois River as "edged with hills, covered with beautiful trees of all kinds, whence you discern vast prairies on which herds of wild-cattle pasture in confusion." . . .

"The fields are full of all kinds of game, wild-cattle, stags, does, deer, bears, turkeys, partridges, parrots, quails, woodcock, wild-pigeons and ring-doves. There are also beavers, otters, martens, till a hundred leagues below the Maroa,† especially in the river of the Missouri, the *Ouabache* (Ohio) that of the Chepousseau (the Cumberland?) which is opposite it, and on all the smaller ones in this part." . . . .

"The cattle of this country surpass ours in size; their head is monstrous, and their look frightful, on account of the long, black hair with which it is surmounted, and which hangs below the chin, and along the houghs of the animal. It has on the back a kind of crest, of which that nearest the neck is longest, the others diminish gradually to the middle of the back. The hair is fine and scarce inferior to wool. The Indians wear their skins, which they dress very neatly with earth, which serves them for paint. These animals are easily approached: they could be easily domesticated."‡

Charlevoix, who passed through the Mississippi Valley in 1721, gives a fine and detailed description of the buffalo, as seen by him on the prairies, and the Indian method of hunting it. As his work is very scarce I transcribe the whole of his remarks upon the buffalo.

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* *Dis. and Ex. of the Miss.* J. G. Shea, p. 108, 109.

† The Tamaroas, a tribe of Indians located just east of the mouth of the Illinois River.

‡ *Dis. and Ex. of the Miss.* J. G. Shea, p. 179, 180.

"In the southern and western parts of New France,* on both sides of the Mississippi, the most famous hunt is that of the buffalo, which is performed in this manner: the hunters range themselves in four lines, which form a great square, and begin by setting fire to the grass and herbs, which are dry and very high; then as the fire gets forwards they advance, closing their lines. The buffaloes which are extremely afraid of fire, keep flying from it, and at last find themselves so crowded together, that they are generally every one killed. They say that a party seldom returns from hunting without killing fifteen hundred or two thousand. But lest the different companies should hinder each other, they all agree before they set out about the place where they intend to hunt. There are also some penalties appointed against those who transgress, this rule, as well as against those who, quitting their posts, give way to the beasts to escape. These penalties consist in giving a right to every person to strip those who are guilty, and to take away even their arms, which is the greatest affront that can be given to a savage; and to pull down their cabins. The chiefs are subject to this penalty as well as the others, and if any were to endeavor to exempt them from this law, it would raise a civil war amongst them, which would not end soon."

"The bull, or buffalo, of *Canada* is bigger than ours; his horns are low, black and short, he has a great beard of hair under his muzzle, and a great tuft of hair upon his head, which falls down over his eyes and gives him a hideous look. He has a great bump on his back, which begins at his hips, and goes on increasing up to his shoulders; and this bump is covered with hair, something reddish, and very long; the rest of his body is covered with black wool, which is much valued. They say that the skin of the buffalo has eight pounds of wool on it. This animal has a large chest, the hind parts small, the tail very short, and one can scarce see any neck it has, but its head is bigger than that of the European bull. He runs away generally at the sight of any person, and one dog is enough to make a whole herd take to full gallop. The buffalo has a good smell, and to approach him without being perceived near enough to shoot him, you must go against the wind. When he is wounded he is furious and turns upon the hunters. He is as

* The whole of Canada together with the country on both sides of the Mississippi, from its source to the gulf, was then claimed by the French, under the name of New France.

furious when the cows have newly calved. His flesh is good, but they seldom eat any but that of the cows, because the buffaloes are too tough. As for his skin, there are none better; it is easily dressed, and though very strong, it becomes supple, like the best Chamois. The savages make shields of it, which are very light, and which a musket ball will not easily pierce."*

On the 6th day of October, 1721, as Charlevoix and his party were descending the Illinois River, he says he saw a great number of buffaloes crossing it in a great hurry, and he scarce doubted but that they were hunted by the Indians. On the next day he passed the mouth of the "*Saguimont*,† a great river that comes from the south; five or six leagues lower down he left on the same hand another, smaller, called the river *Macopines.*‡ These are great roots, which eaten raw are poison, but being roasted by a small fire for five or six days or more, have no longer any hurtful quality."§

In the year 1711, Father Marest made a journey on foot, with three Indian guides, from Cahokia on the east side of the Mississippi, south of the present city of St. Louis, to Peoria, on Lake *Pimetoui*, — this word, in Algonquin Indian, means land of fat beasts. He left the site of the present city of Springfield to his right about six miles, I should judge. He says, "journeys which are made in this country should not be compared with those in Europe. There you find from time to time villages and towns, and houses in which you can rest, bridges or boats to cross the rivers, beaten paths which lead to your destination, and persons who can place you in the right way, if you have strayed. Here there is nothing of the kind, and we travelled for twelve days without meeting a single soul. At one time we found ourselves upon prairies which were boundless to our view, cut up by brooks and rivers, but without discovering any path which could guide us, and then again it became necessary to open a passage through dense forests, in the midst of brushwood covered with thorns and briars, and at other times we had to cross marshes filled with mire, in which we sometimes sank to the waist." . . . . "Besides these inconveniences, common to all those who travel through these de-

*Charlevoix, *Travels in North America*, Vol. 1, p. 92.
†Sangamon.
‡Macoupin.
§Charlevoix, Vol. 2, p. 162.

serted lands, we had the addition also of hunger during the whole of our journey. It was not because we did not see great numbers of stags and deer and particularly of buffaloes, but our Indians were not able to kill any. A rumor they had heard the day before our departure, that the country was infested by parties of the enemy (probably the Sioux), prevented them from carrying their guns, for fear of being discovered by the report when they fired, or of being embarrassed, if it should be necessary for them to seek safety in flight. Thus, they could use nothing but their arrows, and the buffaloes which they hit, fled, carrying with them the arrows by which they had been pierced, and went to die in some distant place." . . . . . "It was not without reason that they feared meeting with any war party of the enemy, for they would have received no quarter from them. Either their heads would have been cut off, or at best they would have been made prisoners, to be burnt at last before a slow fire, or to be used for food in their feasts." *

From the same letter, written at Kaskaskia in 1712, we learn that it was then the constant habit of the missionaries to accompany the Indians in their hunts. There were during the year two great hunts; that of the summer, which scarcely lasted three weeks, and that which took place during the winter, which lasted four or five months. With but a slight exertion of the imagination one can see the motley group of Indians, French and half-breeds, headed by the Blackgown,† issuing from the old Kaskaskia of 1712, where the wigwams of the savage and the rude huts of the French indicated the contact of civilization and barbarism, and turning their faces to the north toward the great prairies where they were to engage in the chase of the deer, the elk and the buffalo.

These old missionaries soon learned to love the rivers and prairies of Illinois and, if duty called them to Canada or the Great Lakes, to rejoice upon their return to the Illinois missions. Father Marest remained a short time with the *Peorias* and then continued his journey on to Michilimakinak. After stopping there a few days he started to return in the bark canoe by the way of the Lakes and the St. Joseph River, called now Miami River. He

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* *Early Jesuit Missions*, Kip, p. 216, *et seq.*

† Everywhere among the western Indians the Jesuits were known by the name of Blackgowns.

says he "ascended the River St. Joseph to the '*portage*.'" Here they transported all there was in the canoe to the source of the Illinois River called *Haukiki*, which was a corruption of the Indian word *Theakiki*. They then carried over the canoe, launched it and continued their route. They were two days in making this portage, aud then followed the windings of the *Theakiki* to the prairies of Illinois, where the old missionary joyfully exclaims, "at last we perceived our own agreeable country, the wild buffaloes and herds of stags, wandering on the borders of the river; and those who were in the canoe took some of them from time to time, which served for our food." *

The buffalo was first seen by Cortez and his followers, in 1521, a single individual being observed in a kind of menagerie or zoological collection of Montezuma, in Mexico. To this place the animal had been brought from the north by Indians, to whom the collection of rare birds and quadrupeds had been committed by the native monarch. It was not, however, till the expedition of Coronado north of the Gila, in 1540, that its natural ranges were penetrated. It was not found at all in the highlands of New Mexico. The Spanish adventurers had passed the Rio del Norte, and entered the region of the great southern fork of the Arkansas, before they encountered the immense herds which they describe. So headlong was the course of the droves of these animals following each other, that they sometimes pitched into and filled up entire gulfs and defiles lying in their track.† The buffalo was found by De Soto (1541) after he had crossed the Mississippi and entered the present area of Arkansas and Missouri.

Audubon and Bachman mention the buffalo as once existing upon the Atlantic coast, and further add that "authors state that at the time of the first settlement of Canada it was not known in that country, and Sagard Theodat mentions having heard that bulls existed in the far west, but he saw none himself." Lawson, in his "Journal of one thousand miles' Travel among the Indians, with a Description of North Carolina" (London, 1700) speaks of two buffaloes that were killed in that State on Cape Fear River. Audubon says that the bison formerly existed in South Carolina

* *Early Jesuit Missions*, Kip., p. 224.

† Discovery and Ex. of the Mississippi, J. G. Shea, p. 18; History, Cond., Prospects etc., Vol. 4, p. 98. Schoolcraft cites Castenada's Narrative of an Expedition to Cibola, etc., p. 34, Mss.

on the sea board, and that he was informed that, from the last herd seen in that State, two were killed in the vicinity of Columbia. "It thus appears that at one period this animal ranged over nearly the whole of North America."* Names of places still retained, in many instances, indicate the former range of the buffalo. A river upon the Upper Mississippi was called by the Indians *Beez-hike Sepe*, or Buffalo River, "on account," Father Hennepin says, "of the number of buffaloes found there." Charlevoix speaks of a river near Niagara Falls, which bore the name of *La Riviere aux Bœufs*, or Buffalo River, which was, no doubt, a French translation of the Indian name. Schoolcraft says that the city of Buffalo perpetuates the tradition of the former existence of the buffalo near Lake Erie. From Charlevoix we learn that, at the time he passed through Lake Erie (1721), the buffalo was still found in its vicinity. Writing from *The Strait* (Detroit), he says, "at the end of five or six leagues, inclining towards the Lake Erie, one sees vast meadows which extend above a hundred leagues every way, and which feed a prodigious number of those cattle which I have already mentioned several times."†

The view that the name *La Riviere aux Bœufs*, and that of the city of Buffalo, perpetuate the traditionary existence of the buffalo at the east end of Lake Erie, is corroborated by the fact, shown by Dr. Elliott Coues in the November number of the NATURALIST, that the buffalo formerly existed on the Kenawha River in Virginia.

Schoolcraft says, "It was found in early days to have crossed the Mississippi above the latitude of the mouth of the Ohio; and at certain times throughout the present area of Kentucky. It not only ranged over the prairies of Illinois and Wisconsin, but spread to Southern Michigan, and the western skirts of Ohio. Tradition says that it was sometimes seen on the borders of Lake Erie. It was also common to the southern parts of Wisconsin, and crossed the Mississippi into Minnesota above St. Anthony's Falls for the last time, it is believed, in 1820;"‡ and Audubon states, "in the days of our boyhood and youth, buffaloes roamed over the small prairies of Illinois, and herds of them stalked through the open woods of Kentucky and Tennessee; but they

* *The Quadrupeds of North America.* Vol. 2, p. 55.
† Charlevoix, *Travels in North America*, Vol. 2, p. 13.
‡ *History, Cond., Prospects, etc.*, Vol. 4, p. 93.

had dwindled down to a few stragglers, which resorted chiefly to the 'Barrens,' towards the years 1808 and 1809, and soon after entirely disappeared."*

From my own reading and reflection upon the subject, I would place the range of the buffalo, before the advent of the whites in this country, within the following area,—beginning upon the Atlantic sea-board at Charleston, thence north of west to the Mississippi, thence down the river to the gulf, thence to the mouth of the Rio Grande, thence up said river to the Rocky Mountains, thence north to the Great Slave Lake in latitude 60°, thence south-east to the source of the Mississippi, thence to the south end of Lake Michigan, thence east to the east end of Lake Erie, thence south-east to the Atlantic coast, near the mouth of Chesapeake Bay, and thence down the coast to place of beginning. I can at least show good authority for the buffalo having been found at all of the extreme limits of the above area, but of course we can only conjecture as to whether it ranged over the whole of the above territory at the first settlement of this country.

But the buffalo has been driven westward until now the area over which it ranges is probably not over one-tenth of that above described. Like the Red Indian it must succumb in that mighty struggle which has been going on from the remotest geological time,—which has literally filled the earth with relics of lost species and still continues to-day, controlled by the same laws, and producing the same effects as it did when the last mastodon laid down to die.

The old French and Indian population, before the year 1812, exterminated the buffalo from the prairies of Illinois, notwithstanding the countless numbers that roamed over them at the end of the seventeenth century and during the first half of the eighteenth. It has not been more than one hundred and twenty or or one hundred and fifty years at farthest, since they were being slaughtered by the thousand everywhere over our state, yet, though for years I have kept a sharp lookout, I have never met with a single bone of this animal.† Audubon states that in the

* *Quadrupeds of North America*, Audubon and Bachman, Vol. 2, p. 36.

† Prof. Worthen informs me that he has found the bones of the buffalo very rare in this state. A portion of a skeleton comprising big bones, ribs, etc. was found with the Niantic mastodon, four feet below the surface; and Mr. Broadhead found a skull only a foot or two below the surface in Christian or Montgomery county, and those are all the remains he knows of having been found recently in the state.

Far West "the prairies are in some places whitened with the skulls of the buffalo, dried and bleached by the summer's sun and the frosts and snows of those severe latitudes in winter."* No doubt their skulls and other bones were as plenty upon the prairies of Illinois a hundred years ago. It seems to be the object of nature as soon as possible after life is extinct to destroy the remains of every organized creature, and to throw back its component parts into the rounds of circulation again, and it is only a very rare accident that even the hardest parts, such as hoofs, horns, teeth, etc., are fossilized. I presume that not one in every fifty thousand, of the buffaloes that were in Illinois during the eighteenth century, will stand a chance to attest its former existence by a single bone at the beginning of the twentieth century. Large numbers of the Elk, *Cervus Canadensis*, grazed upon the prairies of Illinois, as will be seen by the above extracts, and Audubon says, that a few were still to be found in Kentucky, and across the Ohio River in Illinois, at the time he settled in that state. Their horns, which from their size and hardness, were better calculated to resist the effects of time than the buffalo, are sometimes, but rarely, found in our state. Two of them were picked up this year, in Scott County, within ten miles of the Illinois River.

"Instead of its being part of the plan of nature to store up enduring records of a large number of the individual plants and animals which have lived on the surface, it seems to be her chief care to provide the means of disencumbering the habitable areas lying above and below the water, of those myriads of the solid skeletons of animals, and those massive trunks of trees, which would otherwise soon choke up every river and fill every valley. To prevent this inconvenience she employs the heat of the sun and moisture of the atmosphere, the dissolving power of carbonic and other acids, the grinding teeth and gastric juices of quadrupeds, birds, reptiles, and fish and the agency of many of the invertebrata."† No better illustration of these words of Sir Charles Lyell can be found, than that of the scarcity of the bones of the buffalo and other large mammals that once formed a part of the fauna of the great prairies of the Upper Mississippi.

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* *Ibid*, Vol. ii, p. 43.

† *Antiquity of man*, p. 146.

NOTE:—Teeth of the Bison have been found in the Quaternary clays of Gardiner, Me. See NATURALIST, Vol. i, p. 268, note.—EDS.

REVIEWS AND BOOK NOTICES.

THE FOSSIL PLANTS OF CANADA.* —This elaborate work relates chiefly to the Devonian flora of Gaspé and St. John, New Brunswick, and indeed is a revision of the Pre-carboniferous flora of Eastern North America, as the author has introduced "such allied species from New York, Ohio, and Maine as may serve to illustrate the Canadian species." He proposes the term Erian, derived from the great Erie division of the New York geologists, instead of Devonian, hoping "to keep before the minds of geologists the caution that they should not measure the Erian formations of America or the fossils which they contain, by the comparatively depauperated representatives of this portion of the geological scale in the Devonian of Western Europe."

The notices and figures illustrating the Dadoxylon, "evidently an Araucarian conifer" of which no foliage nor fruit have been found, only drifted trunks a foot in diameter; of the Psilophyton, the species of which were "synthetic or generalized plants," having rootlets resembling those of some ferns, stems having the structure of Lycopodium, and rudimentary leaves also resembling those of the club mosses (Lycopodiaceæ), branchlets with circinati venation like that of ferns, and sporangia of a type quite peculiar to themselves, are of much interest. He also describes and figures the trunks of tree ferns from Gilboa, N. Y. "where these trunks are stated to occur in an erect position in sandstone" and are now in Prof. Hall's collection, while Prof. Newberry has communicated to him "two well characterized trunks of tree ferns from the Devonian of Ohio, and another from Gilboa, N. Y. so that the occurrence of large tree ferns in the Erian flora is now well established."

As to Silurian vegetation, a few sea weeds occur in the Upper Silurian limestones of Gaspé, but with them are associated in the lower part of the limestone, remains of the land plant Psilophyton, which suffice to indicate the existence of neighboring land, probably composed of the Lower Silurian rocks, and supporting vegetation. He also announces on a subsequent page his discovery of fossil trees of the type of Prototaxites in the Upper Silurian of England.

*The fossil plants of the Devonian and Upper Silurian formations of Canada. By J. W. Dawson, LL. D, F.R.S, F.G.S. With twenty plates and cuts. Geological Survey of Canada, Montreal. Dawson Brothers, 1871. Royal 8vo. pp. 923. $2.50.

Comparing the Devonian flora with that of the Carboniferous period, so familiar to most of our readers, who have seen the beautiful impression of fern leaves from the shales enclosing veins of coal, our author states that *generically* the two floras are in the main identical. "The most important and characteristic Carboniferous genera are also among those best represented in the older flora. On the other hand, while some Carboniferous genera have not yet been recognized in the Devonian, the latter possesses some peculiar generic forms of its own, and these are especially abundant in the lower part of the system. As examples of such genera I may name Psilophyton, Prototaxites, Leptophleum and Arthrostigma. Further, it may be remarked that these peculiar Erian plants present highly composite or synthetic types of structure, giving to these a more archaic air than that of the Carboniferous flora." "Specifically, however, the Devonian flora is almost altogether distinct from the Carboniferous. Even the same genera are represented by distinct species, and it is possible that some of the few species which we now identify with those of the Coal, will in future be found to be distinct." He remarks that "while the distribution of genera in the Devonian leads us to infer climatal conditions in the main resembling those of the Carboniferous, it would also lead us to conclude that the local diversities were greater, and that there was less of that dead level of similar local conditions which prevailed so extensively in the Carboniferous period. The Devonian plants probably grew on limited rocky islands, bordered by much less extensive and permanent lowlands than those of the Carboniferous era."

Although we have quoted enough to convince our readers that we are indebted to Dr. Dawson for one of the most valuable and entertaining monographs that has enriched our science during the year, we have yet to glean still more interesting results of his patient and extended researches in fossil botany. Questions regarding the origin of the flora as a whole, as well as of the single species, and the death of both isolated species and entire floras, inevitably arise and must be met by the student in science. They are discussed by our author in his usual candid and philosophical spirit. He refers—

"For a moment to views of the sequence of Palæozoic plants which might be entertained in accordance with theories of derivation of species now prevalent. The lower Devonian is dis-

tinguished by the abundance of some remarkable forms referred to algæ of the genera Spirophyton and Dictyophyton of Hall, also for the occurrence of vast quantities of humbly organized acrogens suited for a semi-aquatic habitat, as Psilophyton and Annularia. May not these two groups of plants be related in the way of derivation? Again the synthetic types of acrogens of the lower Devonian, and the prototypal exogens of the genus Prototaxites give way in the middle Devonian to more perfect and specialized types of acrogens and gymnosperms; may they not have been advanced by a process of evolution? Such speculations have charms for persons of vivid imagination, and may be supported by the analogy between the progress of the development of the individual plant and the succession of plants in geological time; but the present case affords to them a support more apparent than real. The gap between the algæ and acrogens like Psilophyton with a well developed scalariform axis is very great. The algæ in question did not precede Psilophyton but were contemporaneous with it, and their association may be explained by the co-existence of submerged shallows favorable to algæ, and swampy flats favorable to Psilophyton and its allies, and by the alternation of these conditions in the same locality. Prototaxites does not change into Dadoxylon. It disappears and is replaced by a type of wood which continues to the present day. Psilophyton continues to exist without improvement along with the Lepidodendra and ferns of the Middle and Upper Devonian, and merely becomes less abundant until it finally disappears. The phenomena are rather those of the gradual extinction of the old flora and the introduction of a new one from some different source. If therefore we desire to account for the succession of floras in this way, we must suppose local extinction and the introduction from another region of plants which in the meantime have been modified there."

In considering the relations of the Pre-carboniferous to the older floras, he considers that in accordance with the views that have been so well illustrated by Prof. Hall as to the derivation of the sediments forming the American Silurian strata from the northeast, and the gradual extension in each succeeding period of land and shallow water to the southwest we should expect to find the oldest land plants towards the northeast. "Accordingly, it is in Gaspé that as yet we have the only link of connection of the Erian flora with that of the Silurian period," *i. e.*, the remains of a club moss (Psilophyton); and he believes that a by no means sparse land vegetation accompanied it. But he boldly inquires whether land plants did not exist in the Lower Silurian, and even hints that we might look for the actual origin of land vegetation in the

Laurentian period. He thinks it "possible that the rocks of Newfoundland or Labrador, or beds now buried under the Atlantic, may be those which alone contain the remains of the lower Silurian plants." The Eophyton of Torell from the primordial or Lower Silurian rocks of Sweden, "if a land plant at all" (for Dawson regards "it as a doubtful plant, similar forms being apparently produced by impressions of feet or fins on the surface of mud"), the author regards as more nearly allied to Psilophyton than to any other genus, saying that "whatever the nature of these forms, they are present in the primordial of America as well. Mr. Murray has found them in Newfoundland and Mr. Selwyn in Nova Scotia, in rocks probably of this age."

"Such views as to a primitive Silurian and Laurentian flora are strengthened by the obvious fact that the plants of the lower and middle Devonian have the aspect of the remains of a decaying flora verging on extinction, and pointing backward in geological time, while those of the upper Devonian give us a great number of new forms and point onward to the Carboniferous. As already stated, the lower and middle Erian flora stands by itself in the prevalence of such archaic, and prototypal forms as Prototaxites, Psilophyton, Nematoxylon and Arthrostigma. Is it probable that it was thus isolated? Is it not more likely that these plants were the successors of an older and more primitive flora?

This is vividly presented to the mind in the Erian conifers. In the lower sandstones of Gaspé we find numerous trunks of large trees, all having the structure of Prototaxites. In the Hamilton Group of New York and in the sandstones of St. John, these are replaced by Dadoxylon, a type extending into the Carboniferous and thence to the modern Araucarian pines. There is no transition from one type to the other, nor are they intermixed in the same beds. The Middle Devonian would thus seem to have been the grave of Prototaxites, and the birth-place of Dadoxylon, in so far as the regions in question are concerned.

Something of the same kind occurs in the Carboniferous, in the scanty and somewhat antique Lower Carboniferous flora pointing backward to the Upper Devonian, just as the Lower Devonian may be supposed to point backward to the Silurian. The above reasons lead me to anticipate with confidence the discovery in the Silurian of a flora similar in type to that of the Lower Devonian, but probably richer in species.

Is it possible to indicate where such earlier flora may be expected? In Eastern America, from the Carboniferous period onward, the centre of plant distribution has been the Appalachian chain. From this the plants and sediments extended westward in times of elevation, and to this they receded in times of depression.

But this centre was non-existent before the Devonian period, and the centre for this must have been to the north-east whence the great mass of older Appalachian sediment was derived. In the Carboniferous period there was also an eastward distribution from the Appalachian, and links of connection in the Atlantic bed between the floras of Europe and America. In the Devonian such connection can have been only far to the northeast. It is therefore in Newfoundland, Labrador and Greenland that we are to look for the oldest American flora, and in like manner on the border of the old Scandinavian nucleus for that of Europe. Again, it must have been the wide extension of the sea of the Corniferous limestone that gave the last blow to the remaining flora of the Lower Devonian; and the re-elevation in the middle of that epoch brought in the Appalachian ridges as a new centre, and established a connection with Europe which introduced the Upper Devonian and Carboniferous floras. Lastly, from the comparative richness of the later Erian flora in Eastern America, especially in the St. John beds, it might be a fair inference that the northeastern end of the Appalachian ridge was the original birth-place or centre of creation of what we may call the later Palæozoic flora, or of a large part of that flora."

Finally, in a supplementary section Dr. Dawson gives us his theoretical views as to the origin and extinction of species. "Some of the forms reckoned as specific in the Devonian and Carboniferous may be really derivative races." These may have originated in one or more of the following ways;—(1) By a natural tendency in synthetic types to become specialized in the direction of one or other of their constituted elements. (2) "By embryonic retardation or acceleration in the manner illustrated by Hyatt and Cope." (3) "The contracting and breaking up of floras." (4) "The elevation of a great expanse of new land at the close of the Middle Erian and the beginning of the Coal period, would by permitting the extension of species over wide areas and fertile soils, and by removing the pressure previously existing, be eminently favorable to the production of new, and especially of improved varieties."

ANTHROPOLOGICAL INSTITUTE OF NEW YORK.*—In a former number we called attention to the organization of this society, of which we have now received the first fruits in the form of a very interesting and important number of its Journal. The publications

*Journal of the Anthropological Institute of New York. Vol. i, No. 1. 8vo pamph. pp. 100. New York. 1871-72. [50 cts.]

of the Institute will consist of Memoirs, which will contain papers more exhaustive in their character than those published in the Journal, which is to contain abstracts of the records of the meetings, the shorter papers and such translations and miscellaneous matter as the committee think worth printing.

The character of the new society promises to be such that only pure anthropological science will be allowed entrance to its meetings, and the list of present officers indicates that its objects will be fulfilled. One of the duties of the president of the society is to give a review of the progress of Anthropological Science during the year, and with Mr. Squier in the chair we look forward to an important contribution as the first annual address.

The present number contains the proceedings consequent to the organization of the Institute, with its Constitution, By-laws etc., and several papers.*

Taken all together we do not know when we have sat down to a pamphlet and read every page with greater interest and satisfaction derived from the knowledge attained, than we experienced while reading the first number of this Journal. We shall make extended quotations in future numbers of the NATURALIST.

BOTANY.

ON UTILITY IN THE SUPERABUNDANCE OF SEEDS AND POLLEN.—In the vicinity of Pike's Peak last summer I noted that *Pinus edulis*, in many instances, had its usually two "leaves" united into one. As winter approaches the terete branchlet, as I call these "needles," divides and exposes the two inner faces. Thus the one year branchlet is terete; when two or more years old the "leaves" are in twos or threes. The trees in this monophyllous condition grow as well, and as far as can be seen, are in as favorable circumstances to engage in the struggle for life as any Pine

* The Progress of Anthropology in Europe and America; a translation, by W. L. Roberts, of Dr. Broca's address before the Anthropological Society of Paris. A review of Von Martius' paper on some points of South American Ethnology, by Charles Rau. Antiquities from the Guano or Huana Islands of Peru, with illustrations, by E. G. Squier. Sculptured Rocks, Belmont Co., Ohio, with illustrations, by W. Ward. Canoe in Savannah River Swamp, with cut, by C. C. Jones, jr. Notes on Trepanning among the Incas, by M. Broca, Dr. Nott, Dr. Draper and Mr. Squier. Followed by miscellaneous matter from various sources, containing Mr. Squier's remarks on the "Arch in America," a letter from Father Mengarini on the Indians of Oregon. Notes and anthropological items from all countries.

can be, whether with one, two, or five leaves, and this too though the inner or, as we would say of true leaves, the upper surfaces, so essential to most plants, do not exist during the growing time.

In my recent paper on Cotyledons ("Proceedings American Association," Indianapolis) I noted that the usually pluri-cotyledonous *Abies excelsa* frequently has but three, and at times but two seed lobes. The number of lobes does not seem in the slightest degree to aid the individual or to exert any influence whatever on the preservation of species.

The trees and shrubs of Europe mostly bear seeds more profusely than closely allied American species. *Quercus robur*, commences to bear acorns when ten years old. It then bears annually. *Quercus alba*, the American white, rarely fruits till fifteen or twenty, and then seldom leaves but every other year, although generally more prolific than any other North Eastern American oak. It never approaches in profusion the best specimens of the English species.

Liriodendron tulipifera appears to have an abundance of pollen, so far as an examination of its numerous flowers indicates. The seeds are distributed by a light wing. The immense majority of the distributed carpels are seedless.

In the Pine family the pollen is in immense profusion. If we climb into a tree just as the pollen sacs are bursting, our clothes are as yellow as if turned out of a mustard bag.

Many observations of a similar character must have been made by every botanist.

At page 183 of this journal, 1871, I said we may say of pollen or of seeds themselves, that "nature makes numberless things for which she has no use whatever. Perhaps it may be, that like the human mind, the mind of nature likes variety and profusion, in the effort for which mere utility is not always consulted." The editors remark—"and of this sort pollen and seeds are queer examples. Does he mean that these are useless because superabundant enough to ensure against risk and loss, and appropriation by animals through which fertilization and dispersion are subserved?"

It does seem to me that no utility is subserved by the division of Pine leaves or of cotyledons; nor in a large number of cases which might be cited as to the mere form of plant structure. In the case of the oak, and other similar instances the American species holds its own against all losses as well as its English brother;

and doubtless would if it only fruited every ten years instead of every two, and especially when we see the Liriodendron with most of its seeds infertile and yet very widely distributed, must we not regard the profusion of English seed useless?

And in regard to the pine pollen, certainly after granting the widest margin for "insurance against all losses," the vast proportion is useless so far as any benefit to the individual or species is directly concerned.* If we regard pine pollen as produced by nature for the purpose not of fertilization merely, but for the purpose of forming coal also (see Huxley on coal), it would suit a popular idea of utility in nature. But the coal formed out of deposits of pollen from Sigillarias and Lepidodendrons, serves no purpose to these plants.

It was in this sense that I meant the over production useless; and in this sense I suppose I should differ from much in modern philosophy, which, as I understand it, seeks in *every production* of life a benefit to the parent which produced it. Yet in one sense the production may not be regarded as useless. A boy whittles

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*In reaffirming our bit of criticism which Mr. Meehan fails to see the point of, it is best to keep the point clear from all heterogeneous matters (such as the nature of pine-leaves and of cotyledons, in respect to which Mr. Meehan's views are very peculiar), and stick to the case of the abundance of pine-pollen, vast in itself and in proportion to the seeds to be fertilized. This excess of pollen Mr. Meehan adduces in proof of the proposition "that Nature makes numberless things for which she has no use whatever." But—to continue the personification—before he condemns Dame Nature for wasteful profusion, let him consider, as she had to do, the conditions of the particular case in hand; viz., a species of tree with flowers of separate sexes, destitute of honey or other enticement for insects, and therefore to be fertilized by the wafting of pollen by the wind, and in view the advantage of wide breeding. Can he be quite sure that there is a wasteful excess of pollen here; and does he not see that, at least, this is not a convincing argument "that nature makes numberless things for which she has no use whatever?"

Now, while we plead "extenuating circumstances" in behalf of Dame Nature in this particular case, it may be allowable to bring testimony to her general good character for economy where no purpose is to be served by profusion. Take the case of those surely fertile little blossoms of Impatiens (referred to on page 109 of this number), or the similar flowers of violets, Specularia, and the like, where nature means close fertilization, and therefore shuts up anthers and stigma together, and endows the pollen grains with the power to send out their tubes from the one to the other—so dispensing with wind, insects, or other carriers—here a superabundance of pollen might imply waste. But in these cases—and in these only—the grains of pollen do not very much exceed the number of ovules to be fertilized!

Apropos to the paucity of seeds which mature in Liriodendron, and that some oaks are much more prolific than others, but the least fertile showing no disadvantage therefrom in the struggle for life, we were disposed to explain how small a factor, comparatively, the mere number of progeny must be in the problem of natural selection. But that is best done by referring to Darwin's "Origin of Species," chapter third, especially to the paragraph in which he states that the Fulmar petrel lays but one egg, yet it is believed to be the most numerous bird in the world."—EDITORS.

a stick, the shavings are of no benefit to him. But the activity which produced the shavings is a power in boy life, other things he does which aid both in the purpose and in the results. He gathers apples. The action serves him, and the result is food for action in the future.

To illustrate this again in plant life. We all know how much time has been given to studying the uses of thorns. What is the use of thorns to a rose. The sweet briar has a few scattered recurved thorns. But when a certain insect deposits an egg in a growing branch, the gall and a portion of stem above and below, become densely crowded with straight sharp thorns. I take it that these thorns are entirely useless to the plant, and yet the vital action which produced them no doubt served a useful purpose; and I should say the same of all the thorns on the whole plant. I suppose some might say that this echinate gall was the result of abnormal vital action, and is perhaps to be credited to the insect which was thus better protected from enemies. But how this larva is better protected by these pines I fail to see. The principle applied to the boy with the shavings seems more philosophical. The thorns are useless, but the action which produced them was not.

I have been content in the past with recording my observations, only occasionally hazarding a suggestion as to the direction in which they pointed. I feel that my field and my opportunities are too limited to allow me to put full faith in my own judgment when opposed to the views of those much better situated to decide. If in this I offer more than my usual quota of opinion, it is out of respect to the editor's inquiry.—THOMAS MEEHAN.

PLANT DRYERS.—The best article I have ever used,—better than any blotting paper—is one of the kinds of sheathing paper made by Messrs. Roberts and Son, of Waltham. In any large quantity it can be had cut to size at the mill. I have just been distributing *two tons* of it among botanists, cut to size of twelve by eighteen inches. Each sheet is like a pad of blotting paper. We stitch from three to five sheets together into a dryer, the specimens being placed between successive dryers, of course enclosed in a sheet of thin soft paper; nothing can be better, nor so cheap. The maker having a small quantity left over from our large order, I have asked the Naturalists' Agency to take it in or-

der to supply botanists, schools, etc., in quantities smaller than can be had from the manufacturers. For price see the advertisement.—ASA GRAY.

LATE FLOWERING OF THE GIBBOUS BLADDERWORT.—This fall I found on the flats of the Charles River, *Utricularia gibba*, covering half an acre of ground in full bloom, October 2d. It continued to send up fresh flowers till cut off by a frost near the first of November. The time given in our works on botany, for expecting this little plant in flower is July and August.—WM. EDWARDS, *Natick*.

NEW AMERICAN VARIETY OF ASPLENIUM FILIX FŒMINA.—In Europe many variations of this fern are given in their manuals, the most prominent of which are vars. rhæticum, multifidum, marinum, crispum, latifolium.

None, however, have been noticed in this country previous to 1869, when several tufts were discovered growing in Wilton, N. H., bearing all the fronds thus peculiarly marked: tips of each pinna fringed with five to eight lobes, tops of fronds tasselled with a cluster of ten to fifteen pinnæ gradually diminishing in size towards the centre, fronds fifteen to twenty inches high, by five to seven wide. In 1870 and 1871 I gathered specimens from the same roots, in all respects like the first.

This variety seems identical with var. multifidum of English works, but as the specimen sent to the herbarium of Prof. Gray at Cambridge bears the name of *Asplenium filix fœmina* var. *cristatum*, it will henceforth be known by that name.—WM. EDWARDS.

INFLUENCE OF GREEN LIGHT ON THE SENSITIVE PLANT.—In order to test the effect of green light on the sensitiveness of the Mimosa, M. P. Bert has placed several plants under bell-glasses of different colored glass set in a warm greenhouse. At the end of a few hours a difference was already apparent; those subjected to green, yellow, or red light had the petioles erect and the leaflets expanded; the blue and the violet, on the other hand, had the petioles almost horizontal and the leaflets hanging down. In a week those placed beneath blackened glass were already less sensitive, and in twelve days they were dead or dying. From that time the green ones were entirely insensitive, and in four days more

were dead. At this time the plants under the other glasses were perfectly healthy and sensitive; but there was a great inequality of development among them. The white had made great progress, the red less, the yellow little less still; the violet and the blue did not appear to have grown at all. After sixteen days the vigorous plants from the uncolored glass were removed to the green; in eight days they had become less sensitive, in two more the sensitiveness had almost entirely disappeared, and in another week they were all dead. Green rays of light appear to have no greater influence on vegetation than complete absence of light, and M. Bert believes that the sensitive plants exhibit only the same phenomena as all plants colored green, but to an excessive degree.— A. W. B.

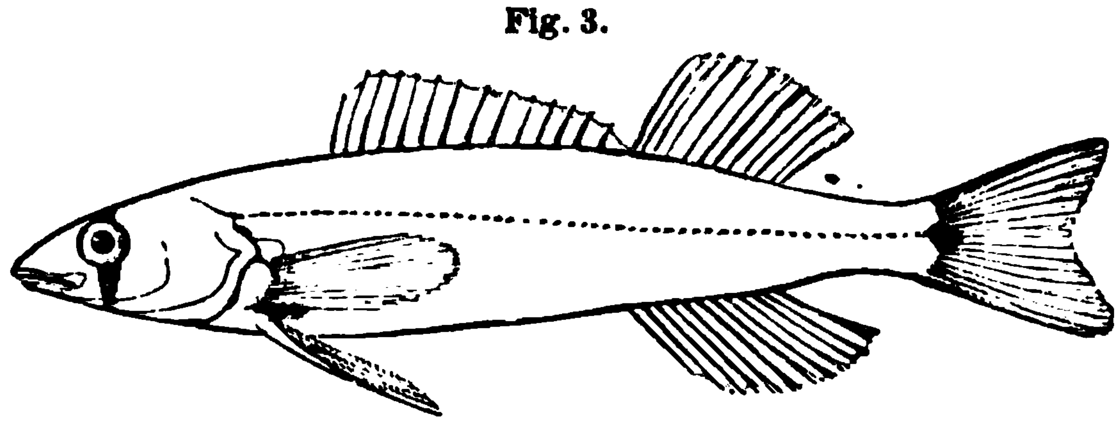
Structure of the Closed Flowers of Impatiens.—At a meeting of the Linnæan Society of London held November 16th, Mr. A. W. Bennett read a paper on the above subject, his observations, made on *Impatiens fulva* Nutt., an American species completely naturalized in several places in the south of England, being substantially in accordance with those recorded by Prof. Asa Gray in his "Genera Flora America boreali-orientalis." Mr. Bennett, however, believes that the closed or "cleistogenous" self-fertilized flowers are not the result of "arrested development," but are from the first of a different nature, and he suggests that the "cap" formed by the unexpanded calyx and corolla may be thrown off the pistil by the elasticity of the stamens, which are of a very different shape and structure from those in the perfect flowers. The anthers do not dehisce, but the pollen, the quantity of which is very small, pierces with its tubes the wall of the anther in order to reach the stigma. The plant does not appear to be visited by insects in England; the conspicuous flowers, in which there is a provision to prevent the pollen reaching the stigma consequently seldom produce pods, while the unopened flowers do so abound invariably.— A. W. B.

ZOOLOGY.

The Etheostomoids.—Having been for several years specially interested in this little group of Percoids, of which I am now engaged in completing a monograph, and wishing to secure

all the material possible before publishing the work, I take this means of asking all who are willing to give their aid to collect specimens for me. The specimens already in my hands consist of the large collections belonging to the Smithsonian Institution and the Museum of Comparative Zoology, the smaller collections of the Boston Society of Natural History and Peabody Academy of Science, and many type specimens received from Prof. Cope

Fig. 3.

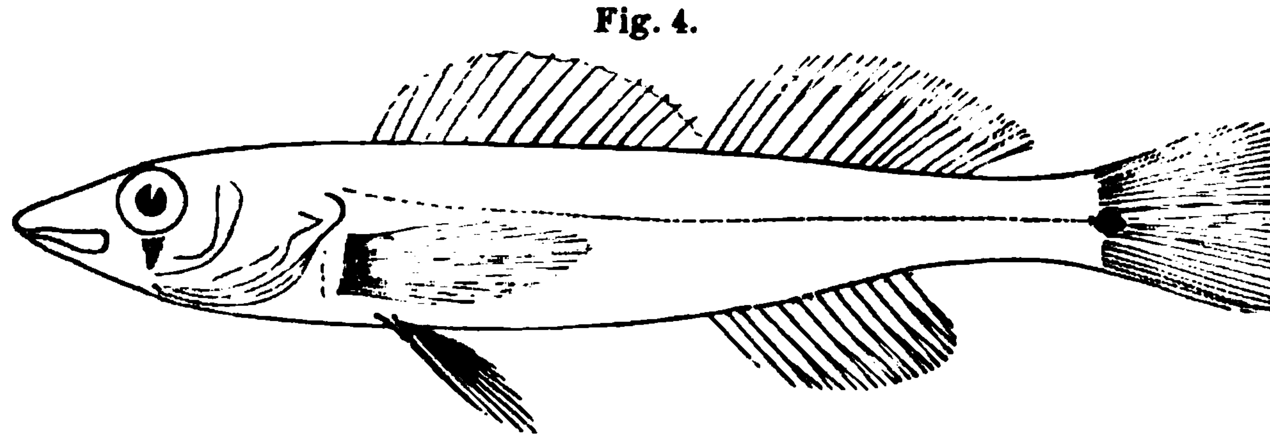


Hadropterus.

and Dr. Abbott. Besides these, all the types of Girard of the specimens described in the Pacific Railroad and Mexican Boundary Surveys, the types of Agassiz' species and such as still exist of Haldemann's and Storer's have been carefully studied. From this material about forty species have been recognized and several others are indicated by single specimens.

The great variation between individuals of the same species makes it essential to have a large number of specimens from as

Fig. 4.

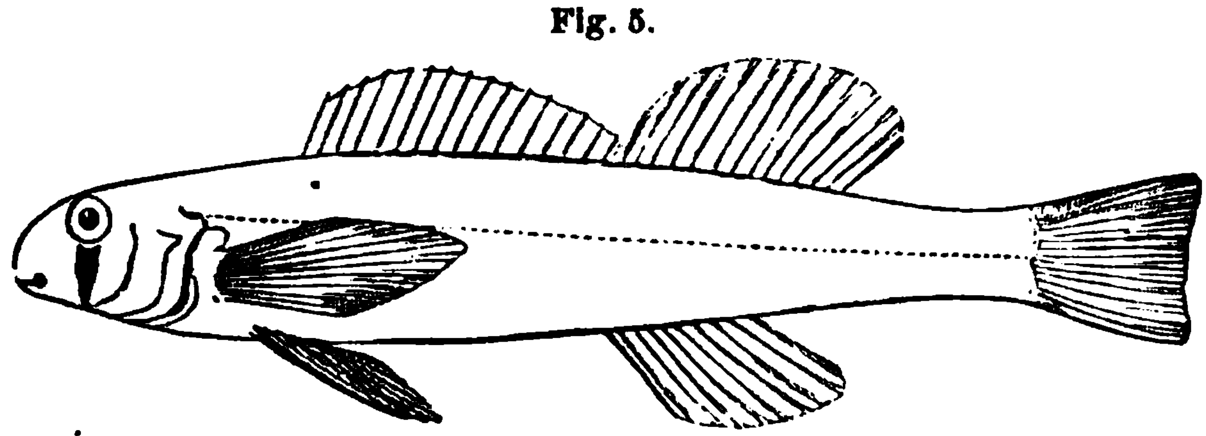


Percina.

many localities as possible in order to determine the species with any degree of certainty. Especially is this variation noticeable between males, females and young, and between males and females at the spawning time and those taken later in the season. In early spring the males of many of the species are most brilliantly arrayed in blue, orange, red, and other bright colors, while in summer and fall these colors are entirely lost or greatly changed. In many species where the males show a decided difference of

coloration from each other the females will be so similar in their plain markings as to make it almost impossible to separate them. There is also considerable variation in the shape of the fins between the males and females of some species, especially noticeable in the genus Catonotus, in which the spiny dorsal fin of the male is short and each ray usually terminates in a little knob, while in the female the rays are longer, and are without the

Fig. 5.

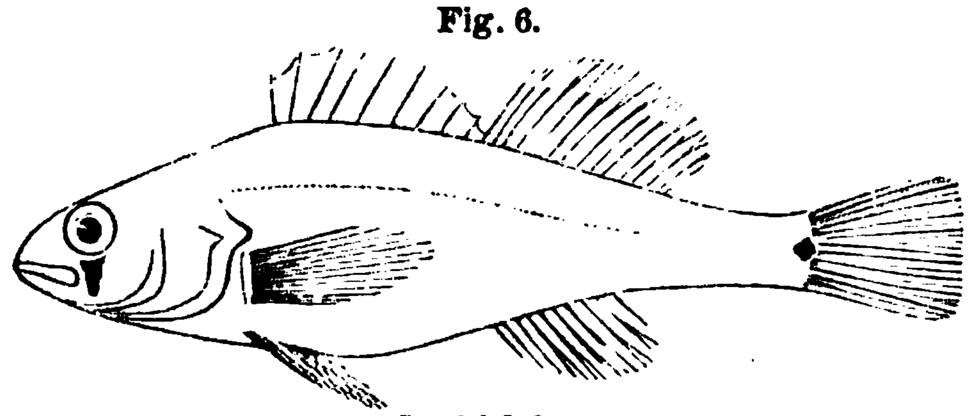


Hyostoma.

knob. Pages could be written on the variations which individuals of the different species exhibit when a large number of any one species has been carefully examined, but enough has been said here to call attention to the necessity of securing all the material possible for the work on which I am engaged.

These small fishes have the general appearance of young perch, and combine the habits of the perches with those of the little fresh water bull heads (Cottoids) or "miller's thumbs" as they are called in England. They are found in nearly all locations, including lakes, ponds, rivers, small streams and ditches. The sandy and gravelly shores of lakes

Fig. 6.



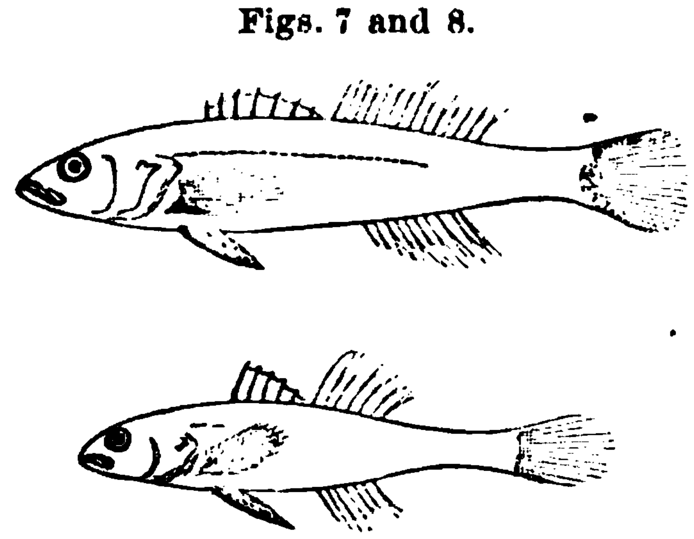
Pœcilichthys.

and ponds are favorite spots, as well as the grass and weed grown shallow parts of rivers, or the clear rocky stream. Several of the species are in great part surface swimmers, but by far the larger number pass most of their time on the bottom, darting about from stone to stone or in and out among the water plants. From this habit of moving by quick, short, and often zig-zag darts they have received the common and very appropriate name of "darters," and in many localities are well known under that name. A few

of the species attain four or five inches in length, but by far the larger number never exceed three inches, and many not over one and one-half to two inches. The outline cuts here given (Figs. 3–8) are all of natural size and roughly exhibit several of the more prominent forms.

These little fellows are generally quite difficult to catch until one gets familiar with their ways of darting about, but with a little practice and some patience they can be secured with a hand net or by driving them into a set net. But the way to catch them in large numbers is by drawing a seine, with very small meshes, along the banks of a lake, pond, or river, or up a narrow stream. In this way I have often succeeded in obtaining from four or five to forty or fifty specimens at a single haul of a fifty foot seine on the sandy shores of Lake Champlain. In August last, when fishing on the Wabash River, very successful hauls were made by dragging a fifteen foot seine along the shallow banks of the river over the water plants, which was easily done by one person wading up stream in about two or three feet of water, holding down one end of the seine and another person holding the seine down at the other end, in such a way as to let it bag considerably down stream, and every now and then dragging the seine ashore. In this mode of fishing care must be taken to keep the lead line well down on the bottom or the fishes will dart under. To a person who has never tried seining in this way a few hours of such collecting will secure to him more specimens of all that swim in the locality than he has thought it possible to obtain. A very successful way of collecting these darters, if you only have a scoop net, is to scoop about among the water plants, or over a muddy, leafy, or stony bottom, stirring up the bottom and getting the water so clouded as to confuse the fish, and by going backwards and forwards over the ground and every few moments emptying your net, many specimens may often be secured.

Figs. 7 and 8.



Catonotus. Microperca.

The Etheostomoids are widely distributed in the fresh waters of North America east of the Rocky Mountains, and I now have specimens taken from Hudson's Bay to Georgia. The species in

New England are very limited, only two or three having as yet been found, but in the central, north-western and southern states they are far more numerous, and the Ohio valley seems from present data to be the great centre of distribution of the group.

The method of preserving fishes is looked upon by persons not familiar with collecting as a difficult operation, and has always been a "bugbear" in the way of securing specimens of the class. I therefore offer the following simple means of preserving any small fish. If you intend collecting largely and are provided with a small seine or good hand or minnow net, it is best to go well prepared with vessels in which to place your captures, and for this purpose any strong bottles, jars or cans answer well. Pickle jars with good corks, or some of the patent preserve jars or cans are excellent, and handy to carry in basket, bag or pocket. Always, when you start out, have the collecting jars about one-third or one-half full of alcohol or unrectified whiskey (high wines), or if these can not be had readily, take common drinking whiskey or almost any spirit, as a substitute. When you get the specimens put them at once into the spirit before they have a chance to harm their fins and scales by thrashing about in the net or on the shore. It is always my plan to put the specimens I want to preserve *immediately* into my collecting jars from the net, not allowing them the slightest chance to get injured, and as the alcohol kills them almost instantly they are not harmed by dying, as is the case when left to die on land or in a pail of water as is so often done. By pursuing this course any fishes captured at the same time, and not wanted, can be returned to the river. When one wishes to study any species alive, the best way is to put two or three specimens only in a jar or pail to take home for the purpose, for if more are placed in one jar they will almost invariably die before being able to reach home with them.

While collecting you can fill your jars to the brim with specimens, provided you put them in alive and tip the jars as they are filled so that the spirits will come in immediate contact with the specimens as they are put in, but after you get home it is best either to add more spirit to the jar, or if weak spirits have been used pour it all off and fill the jar as full as you can with specimens without jamming them and then pour in all the spirits you can; tuck in a little soft paper, or rags, to stop the top ones from shifting about, and wrapping your bottles in paper or cloth put them in

a box, packing with sawdust if you can get it handy, if not with shavings, hay or grass, and send by the first express to their destination, that they may arrive before the spirits get weakened or the natural colors of the fish are lost or changed by the alcohol. As the Etheostomoids are all small fishes, common ale or junk bottles can be used in collecting or packing them up for sending away, as the specimens can be readily taken out by breaking off the neck of the bottle.

Common glycerine will answer the purpose of preserving the brilliant colors of the fishes, and it would be very desirable to have a few specimens of each kind put up in it for the purpose of making sure of the natural colors, though from its strong contracting powers specimens so preserved are not so good for general study as those put in alcohol. It would also be very desirable to have a number of specimens, especially if of brilliant colors, preserved so as to retain their colors, in the following way. Take the specimen as soon as dead and cut off a portion of one side, taking out the intestines and such of the flesh as you can take off by a simple cut, then pin it on a card, cut side down, and spread out the fins; then put on a thin coat of varnish, or, if no varnish is at hand, simply let the fish dry *in the shade*. By this simple method the natural colors will be preserved for a long time. By using a little care and putting cotton in the abdominal cavity and a little arsenic on the flesh, very handsome and interesting specimens can be made.

It often happens that a person obtains one or two specimens of a fish he would like to forward, but hardly thinks it worth while to send so small a lot by express. Such can readily be sent by mail at letter postage (three cents for every half ounce) by putting the specimens in a small tin or wooden box, with a little cotton or a rag that has been soaked in alcohol or glycerine and squeezed out (the specimen also having been first put in alcohol or spirits of some kind, or glycerine, for an hour or two). A specimen thus put up can be several days on the route without being injured.

In concluding my request for specimens of fishes of this family I beg to state that any other specimens would be very acceptable to our collection, and that any thing sent by express directed to the Peabody Academy of Science, Salem, Mass.,* will be most

*In sending specimens any express charges will be willingly paid on receipt by the Academy, and special arrangements will also be made to supply any person willing to collect for me with alcohol and jars.

thankfully received and acknowledged. I may also say that a copy of the "Monograph of the Etheostomoids," when published, will be furnished to all persons who kindly assist in the work by sending specimens; and that all notes on the habits, time of spawning, natural colors, etc., will be duly acknowledged in the work, which will form one of the series of illustrated monographs published by the Museum of Comparative Zoology. It is proposed to describe and figure every known species of the group.—F. W. PUTNAM, *Director Peabody Academy of Science*, Salem, Mass.

BUTTERFLY NOTES, 1871.—As bearing on the winter history of the species, an interesting capture of a much worn and faded female Archippus was made by me, May 12th, in this place—Amherst, Mass. The only Niphon taken during the season was found on May 18th. The 23rd, Vialis appeared and soon was very common. Phaeton was first seen June 5th, and, contrary to the usual reports, was not confined to a small locality, but became rather common in several directions from the village. June 9th, a single dimorphic female Hobomok was captured; suspecting it to be such and to have been described as Pochahontas and Quadaquina, I wrote to a distinguished lepidopterologist, who informed me that, on his pointing out the fact, Pochahontas was acknowledged by its author to be a dimorphic Hobomok; my specimen also agrees with a named Quadaquina received from a writer who has publicly stated his belief that it is the same as Pochahontas. July 8th, found Metacomet and Egeremet, males, abundant on Indian Hemp flowers and took Mopsus on an umbelliferous plant. Calanus (Westw.)—the *C. inorata* of Grote—was met with July 17th and Aug. 2nd. A single Delaware was taken by a neighbor in July. A harvest of butterflies was reaped, Aug. 2nd, on flowers of the mountain mint (*Pycnanthemum incanum*), at the foot of the Holyoke range; among them were Melinus, Mopsus, Smilacis and Edwardsii—the latter two very abundant, and the Edwardsii showing either a seasonal or regional variation from New York specimens, being smaller and the markings tending more to lines. On the top of the Holyoke range, Lucilius was frequent, and near the top a Portlandia confidently observed and the beautiful moth, *Callimorpha interrupto-marginata* taken. A visit in August to the Green Mountains in the region of Conway, Ashfield and Goshen, revealed nothing different from Amherst—none of the species that

might be set down as belonging to a Canadian fauna. The last butterfly of the season that is noteworthy was a single Milberti; frosts had come, and all the butterflies had disappeared except Philodice, rapæ and Americanus. In the course of the season, Marcia was frequent; it is not in the New England catalogue, perhaps because not regarded as distinct from Tharos. Cybele and Aphrodite were alike common, the latter the more so. A few unquestionable Cybeles had somewhat the red flush of Aphrodite. Archippus exceptionally very abundant. Graptus rare. Sassacus and Mystic common. Of the Nisoniades, some of my dates are: Lucilius, Ennius, Juvenalis and Persius, May 27th— the first also August 2nd, and the second also June 10th; Icelus, June 3rd and Horatius July 24th. The following New England butterflies have not been observed: Protodice, Eurytheme, Lisa, Delia, Genutia, Epixanthe, Porsenna, Lucia, Clothilde, Acadica, strigosa, Angustus, Henrici, Atlantis, Montinus, Claudia, Nycteis, Harrisii, Cœnia, gracilis, Faunus, Semidea, Bachmanii, Catullus, Lycidas, Verna, Wingina, Acanootus, Manataaqua, Manoco, Hianna, Panoquin, Mesapano, Logan.—H. W. Parker.

Iowa Butterflies.—To the lists hitherto published are to be added Phaeton, Acadica, Thoe, and the following Hesperians: conspicua, Otho, Zabulon, Massasoit, Poweshiek,—all from Central Iowa, namely Poweshiek and Jasper counties.— H. W. Parker.

Young of the Blind Fish.—Dr. Hagen gives me the following information about the young specimens I mentioned (page 15) as belonging to Dr. Steindachner, which I just missed seeing before they were sent to Vienna. These specimens were procured by Dr. Hartung for Dr. Steindachner under the following circumstances. Just as Dr. Hartung was leaving the cave hotel on Oct. 21, a bottle was brought to him containing four specimens, one of which was smaller than the others (probably Typhlichthys), all living. He immediately transferred them to a jar containing alcohol and took no notice of them until he reached Nashville, when he discovered an addition of *eight little ones* in the jar.

The birth of these young was undoubtedly due to placing the parent in the alcohol, and the date (Oct. 21) would correspond to the time I stated in my paper as probably that at which the young were born.

Dr. Hagen states that he examined the young under a lens with-

out taking them from the jar and *could not discover any eyes.* The specimens were about three lines in length.

So now we have two more facts to add to the history of the blind fishes (though whether they apply to Amblyopsis or Typhlichthys is not yet settled). First, that the young are born in October, and second, that they are without external eyes when born.—F. W. PUTNAM.

GEOLOGY.

GEOLOGY, ETC. IN CALIFORNIA.—At the regular meeting of the California Academy of Sciences Dec. 4th, Professor Whitney presented a variety of fossils found in limestones one hundred miles east of Elko. He then read a paper descriptive of his labors in the projection of a topographical map of the State, and exhibited several proofs or specimen copies to the members. They were most complete and elegantly engraved. He had commenced the publication of a volume on the geology of the State, and would probably compile three on the same topic. He also exhibited the first volume of the "Birds of California," containing seven hundred illustrations. This, the first volume, was devoted to the land birds of the state. The "Botany of California" was also in preparation. It is not to be illustrated. Salvador Morthange, consul-general of Belgium, was introduced to the Academy and read a highly interesting paper on White Island, in the bay of Plenty, New Zealand.

Professor Marsh, of Yale College, made a few remarks on his recent explorations. He had been out since June from New Haven, and had spent two months in collecting vertebrate fossils. He had discovered probably about fifty new species from the Miocene and Pliocene deposits, embracing a large variety of extinct reptiles. In Eastern Oregon he had made discoveries which would seem to clear up the geological puzzle in regard to the fresh water lakes; and also a large number of fossil horses, some but two feet in height, and some of the two-toed type had been collected.

Dr. Blake read a paper on the water of the "Devil's Inkstand," at the Geysers, which he found to contain a large quantity of ammoniacal salts.—R. E. C. S.

ORIGIN OF THE NEW ENGLAND GLACIER.—Professor Dana contributes an important article to the "American Journal of Science"

on the icy plateau which gave rise to the great New England glacier. He locates this *mer de glace* between Lake Temiscamang and Lake Mistissinny, on the Canadian watershed. During the glacial period the watershed was probably five thousand feet above its present level, while the White Mountains, the Green Mountain peaks, and the Adirondacks stood five hundred feet higher than they do at present; so that there was a sufficient inclination toward the sea-coast to allow of a movement in a southeast direction of the mass of ice.

ANTHROPOLOGY.

SCALPING.—THE "Friend of India" contains a letter from the Superintendent of Police in the north-eastern district of Bengal, giving an account of *scalping* among the wild tribes on the frontier of that district. In commenting on this letter the journal above named says, "The Naga tribes use the scalping-knife with a ferocity that is only equalled by the American Indians, and the scalps are carefully preserved as evidences of their prowess and vengeance over their enemies. On the death of a chief, all the scalps taken by him during his warlike career are burned with his remains."—*Jour. Anthr. Inst. N. Y.*

ARCHÆOLOGICAL CHRONOLOGY.—According to a notice of his "Essai de Chronologie Archéologique" in "Pall Mall Budget," Professor Forel draws a vivid picture of the time which has elapsed between the deposition of the Schussen glacial beds and the earlier lake habitations. A lapse of time of unknown duration had passed away, and at the commencement of the lacustrine epoch the following changes were accomplished. The fauna had changed. The reindeer and the mammoth had passed away, the *Bos primigenius* alone surviving as a contemporary of the wild boar, red deer and roebuck. The flora had changed. To the Alpine flora, with its scanty vegetation of mosses and lichens which were just able to grow on the ice-mud, had succeeded rich and brilliant forests composed of all our indigenous species of trees. The level of the lake had fallen 30 mètres, and had assumed its present aspect. And man seems to have changed from the poor reindeer hunter of the Salève to the intelligent and active fisher, agriculturist and manufacturer, to whom are due the relatively highly civilized lake habitations of ancient Switzerland. But the use of metal had not been introduced yet, and pottery alone indicates the comparatively high grade

of civilization at which the builders of the *pfahlbauten* had arrived. Long after came the ages of bronze and iron, and finally the Roman period, with its fixed dates and absolute chronology. A rapid review of the history of humanity in Europe shows us an uninterrupted series of events, looking back from the Roman period, through the various lacustrine epochs as far as the most ancient remains of polished stone. But there occurs a gap. We are not in presence of fixed dates, and the continuity of the events alone gives us a perfect key to their relative antiquity. Professor Forel asks—has this lacuna lasted a hundred years, a hundred thousand, or millions of years? And, while he does not attempt to precisely estimate its duration, he proves convincingly that the gap is considerable, but that it is not enormously large. The age of trees which must have grown in the rich vegetable beds of Morges, after mould had been slowly formed from the débris of the pebble beds of the glacial period, indicates a vast lapse of time. Professor Forel enters at great length into certain results at which he has arrived after sounding the Rhône at various levels, and precisely estimating the amounts of mud which the river annually transports. He considers that a space of 300,000 years is necessary in order to fill the lake of Geneva, and that in time the lake will be entirely filled up. His conclusions, in fact, are that the space of time which separates the archæological ages of the reindeer and of the red deer (palæolithic and neolithic epochs) is considerable, and ought to be counted by thousands of years; it is not infinitely great, and ought not to be counted by millions of years.

MICROSCOPY.

"POWER" OF LENSES.—For some three or four years some American microscopists have been calling attention to the "deception" commonly practised by most working opticians in calling the "power of their instrument less than it really is—*i. e.*, calling an objective a quarter-inch when its focus is really but one-fifth or one-sixth of an inch—or an eighth when actually a "one-ninth or one-tenth,—and some now approach to one-twelfth."

In the "Monthly Microscopical Journal" for December, 1871, Mr. F. H. Wenham writes a paper in reply to one of Mr. E. Bicknell's on this subject in which he takes Mr. Bicknell to task for exposing the deception,—and admits the truth of the charge.

Here we have a gentleman, well known throughout the microscopical world as one of the most accomplished *theoretic opticians* of London, generally supposed to be the principal advisor of the working opticians, not apologizing for, but practically defending the imposition, one that has been exposed and complained of by Dr. Wm. B. Carpenter * and also by a writer in the "Quarterly Journal of Microscopical Science."

Mr. Wenham says "a scientific microscopist gives the diameters with his illustrations and the nominal power of his object glass; this quite meets the case." In this Mr. Wenham is entirely wrong; it does not meet the case. A power of one-thousand diameters obtained with a one-inch objective is a very different thing from one-thousand diameters obtained with a one-tenth, *unless the one-inch is ten times as good an instrument as the one-tenth.* The scientific microscopist should give with his illustrations, not only the amplification he employed, but the real focus of the objective, and the name of the maker, as astronomers do in the case of their telescopic observations.

He farther says, "in such a difficult and complex arrangement as a high power object-glass, it is almost impossible for all the makers to work to the same magnifying standard." That of course depends on the knowledge of optics possessed by the workman, but has nothing to do with the matter. When the object-glass *is made*, the focus can be measured, and the glass named accordingly. The nearer the actual power comes to that intended, so much the more credit to the maker — the farther it is from what he sells it for the more to his discredit. It is an axiom in microscopy that the lower the power of a glass that will give a certain result or effect, the better the glass.

Mr. Wenham's comparison with the steam engine is as inappropriate as Hartnack's objection to English microscopes, that with their wheels and screws they look like a steam engine.—C. S.

PHOTOGRAPHIC MICROMETER AND GONIOMETER.—J. C. Southworth, of Georgetown, D. C., proposes, in the "American Journal of Science and Arts," a photographic positive on glass as a substitute for the ruled micrometers. Lines of one-sixth inch interval are reduced by photography to $\frac{1}{250}$ inch, mounted in balsam, and used like the ordinary eye-piece micrometers. The lines are black

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* The Microscope, etc. London. 1868. p. 184.

and distinct and the intervening spaces are said to be sufficiently translucent, which would suggest that the contrivance is best suited for the rapid and easy performance of easy work.

Similarly a goniometer is made by reducing a graduated circle of eighteen inches to a transparent positive of suitable size to be placed in the draw-tube below a positive eye-piece. The eye-piece is furnished with a cob-web line, and its rotation is easily read off on the scale in its focus. This goniometer, which could be made for a few shillings, would seem to be a valuable accessory to all microscopes, especially to those not possessed of a graduated concentric stage.

THE DIATOM HOAX.—Many readers have enjoyed, in a late medical journal, the ingenious essay on test-objects, in which the new immersion one-seventieth of 191°, wet with fluoric acid and illuminated by a new eccentric parallelopiped with fluorescent rays exclusively, is represented as revealing that the structure of *Pleurosigma angulatum* is like the Nicholson pavement; and that a new diatom, fortunately rare, has beads, more than one hundred and forty-seven millions to the inch, which are invisible by all other lenses and to all other observers. They will be further amused by learning from the "Boston Journal of Chemistry" that some foreign medical journals have seriously reviewed this burlesque and discovered it to be a hoax.

THE RED BLOOD-CORPUSCLE.—Mr. E. Ray Lankester presents in the "Quarterly Journal of Microscopical Science" an interesting contribution to our knowledge of the physical structure of the red blood-corpuscle and the action of gases and vapors upon it.

The red blood-corpuscle has no outer coat distinct from its contents and having a pronounced inner limitation, none being visible under the highest powers of the microscope (what might be mistaken under low powers for such proving under high powers to be an illusion of refraction), and the corpuscles, torn or cut by drawing a needle across the slide, suffering no escape of viscid material from their interior, but furnishing portions which by the collapse of their edges assume a rounded form; yet their surface must be differentiated into a film or pellicle having no definite inner boundary, and similar to the pellicle which forms on a cooling mass of jelly, since they become wrinkled when subjected to oblique pressure and recover their form and outline again with great elasticity and precision.

The stroma of which the viscid mass mainly consists appears homogeneous in the mammalia, but contains a nucleus in the other vertebrata. This nucleus, though undetected by Savory, seems to exist in perfectly fresh corpuscles, and has been detected in blood while circulating in the vessels of the frog. It is somewhat indistinct, though a temporary delimitation may be caused by certain physiological conditions of the animal, and after removal from the circulation it becomes sharply and permanently defined.

The usually described forms characteristic of certain classes of animals, are not believed to be the only normal forms. The blood of the frog seems to vary at different seasons of the year, and the ordinary biconcave discs of human blood may be more or less replaced, in fresh and perfectly healthy blood, by the "thorn-apple" and the "single" and "double watch-glass forms."

The macula discovered by Dr. Roberts of Manchester in the blood of all vertebrata are strangely ignored by most of the recent authorities, though published many years ago. They are fully verified by the author's researches. A part of the matter composing the corpuscle segregates to form spots, usually one in man but often three or four in the frog, which are ordinarily imperceptible, but which are deeply stained by nitrate of rosanilin, and form sharp little pullulations under the influence of tannin. Whether the development of these macula is *post-mortem* or not seems to be undetermined.

That the corpuscles are not in the condition simply of a moistened membrane is shown by the very curious observation that they will readily float out of the plásma into a drop of oil. When separated in this manner from the plasma they show a strong tendency to cohere and thus assume hexagonal forms, just as they sometimes do when a thin film of blood is dried upon a slide.

The appearance and disappearance of the granulation of the nucleus and other effects demonstrated by Stricker to take place when blood, after contact with aqueous vapor, is exposed alternately to carbonic acid and atmospheric air, is proved to be due to the alternate presence and absence of the carbonic acid, and not in any part to the oxygen of the atmosphere, since the air may be replaced in the experiment by hydrogen or other gases.

The action of chloroform and many other re-agents upon the corpuscles is studied minutely, but without as yet throwing the desired light upon their effects when introduced into the living system.

The preservation of blood absolutely unchanged in appearance is essential to a successful study of its structure. Hitherto the inadequacy of most students' microscopes and the necessity for immediate and hasty inspection of blood has almost prevented its successful study. To these reasons it should be added that only the few students who make somewhat of a specialty of this branch of science can become sufficiently expert for its more difficult investigations; and the author's estimate of drying as a means of preserving blood, that it is of little or no use, meets with an important exception in the case of studies as to the class of animals to which a given specimen of blood belongs, and also in the determination of the existence of certain diseases. For all purposes, however, it is desirable to preserve the corpuscles in their natural state, and osmic acid has been successfully introduced for this purpose by Prof. Max Schultz. A film of blood on a glass cover is exposed for three minutes to the vapor arising from a bottle of two per cent. solution of osmic acid; after which it may be immediately mounted in a nearly saturated solution of acetate of potash. "Every corpuscle thus becomes 'set,' as it were, in its living form."

A New Group of Infusoria.—In studying the blood of frogs Mr. E. Ray Lankester has sometimes noticed a little parasite which was at first mistaken for a very active white blood-corpuscle. This new infusorian, which is figured in the "Quarterly Journal of Microscopical Science" for October last under the name of *Undulina ranarum*, is a minute pyriform sac, the narrower end of which is somewhat twisted and spirally bent round upon itself, giving it a strikingly shell-like appearance. It has neither mouth nor cilia, but instead of the latter a broad, toothed, undulating membrane which makes it the type of a new group of infusoria.

Structure of Minute Organisms.—The "New York Evangelist," in describing with very natural admiration the beautiful Moller's Type Plate (the *diatoms* of which, by the way, are undoubtedly vegetable and not animal organisms), raises again the question whether these minute organisms may not be possessed of organs and tastes corresponding to those of higher aminals. Persons having an intelligent interest in the science of microscopy, but unfamiliar with its details, cannot be too well assured that the extreme simplicity of the lower organisms is a fact of positive,

not of negative, knowledge,—a conclusion reached from what we see, and not from what we fail to see.

PURE WATER.—Dr. Burdon Sanderson, F.R.S., found it impossible to obtain optically pure water. The fusion of ice furnished the nearest approach to this standard.

RAILWAY DUST.—The "Manchester Guardian" publishes a study of railway dust made by Mr. J. Sidebotham, who finds it to consist, in the case examined, about one-half of particles of iron, and the other half of cinders, sand, etc. Some of the particles of iron were magnetic, and most were sharp, rough and irritating.

NOTES.

WE make the following extracts from a letter to one of the editors from Mr. Dall, Chief of the Coast Survey Expedition to explore the hydrography and natural history of Alaska. It is dated Harbor of Iliuliuk, Unalashka, Alaska Terr., Oct. 30, 1871:

"We arrived here on the 23d of September after a disagreeable passage of twenty-six days from San Francisco, during which, however, we obtained some very interesting observations on the currents. We have been very busy since we arrived, and have accumulated abundance of material to keep us busy all winter, both in regard to Natural History and Hydrography. This harbor is a fine one, and we have a chart well under way and hope by spring to have it approximately complete. Tidal and current observations are going on, we have taken many hundreds of angles and shall go to sounding bye and bye.

The island when we came was a mass of verdure up to the snow caps of the highest peaks. There are no trees, except half a dozen planted by Veniaminoff, the apostle of the Aleuts, in 1805. They are Sitka spruce, very stout and thick, but only about fifteen feet high. The indigenous shrubs and willows are seldom more than six feet high and an inch or two thick. I went on an exploring trip the other day in the interior of the island and with the exception of some wood which we packed on our backs for kindling, we had to boil our tea with green huckleberry bushes! But the herbage is very rich and rank. Sheep and pigs do exceedingly well here with less care than they need at home and I believe hardy cattle would do the same. The winter is wet and windy, but not cold; there is a good deal of snow but it melts very quickly after it falls and rarely lies on the ground any length of time except in severe seasons. The waters abound with fish but there are no land animals, except spermophiles and foxes. Whales are very

often seen inside the harbor. Birds are rather plenty at this season and probably much more so in summer.

This month and the next are the worst of the year. We have had more or less rain almost daily, but also a good deal of sunshine, more indeed than I anticipated. The weather has been comfortable, temperature averaging 44° Fahr. It has not been lower than 32° yet and that only once, still the snow has crept down the mountain sides a thousand feet and we have had several real old fashioned snow storms.

All hands have worked together harmoniously and with energy. I think the prospects for a good season's work are very favorable."—Wm. H. Dall, *Actg. Asst. U. S. C. Survey.*

T. Sterry Hunt, LL. D., chemist to the Canadian Geological Survey, has been appointed to the chair of Geology in the Massachusetts Institute of Technology.

Some one writes to "Land and Water" that though the menagerie at the Jardin des Plantes is at a low ebb, still specimens are being forwarded by the various agents with all speed, and we may hope soon to see it with some of its former glories.

Prof. C. F. Hartt has recently returned from his explorations in Brazil, having specially studied the supposed Amazonian drift beds; and Prof. Marsh has returned to New Haven, with immense collections of fossil vertebrates, etc., from the Rocky Mountains.

Prof. H. James Clark, of the University of Kentucky, has been appointed Prof. of Veterinary Science in the Massachusetts Agricultural College.

Dr. G. Hartung, the well known geologist and author of the splendid works on Madeira, Lancerota, Teneriffe and the Azores, has recently made a geological trip through this country, so as to be able the better to study American works on geology. We also learn from Prof. Hagen that two other German geologists of good reputation, Drs. Reiss and Stuebel, authors of works on Teneriffe, and Santorin, have been geologising for two years past on the west coast of South and Central America, and travelling thence from New York to California, design to go to the Hawaiian Islands to investigate their geology with a view to publication.

How interesting a collection illustrating the products, habits and homes of insects, as well as the relations of zoology and botany to agriculture and the arts may be, is to be seen in a visit to the Museum of the Agricultural Department at Washington, the

result of many years' work of Mr. Townend Glover, to whose unrequited labors in practical entomology we have previously called attention.

He has a beautifully illustrated manuscript work on the insects injurious to cotton and other crops, which thus far Congress has been asked in vain to publish. To the great value of the museum Prof. Hagen of the Museum of Comparative Zoology at Cambridge bears the following testimony. "I find no notice in the NATURALIST of the Museum of the Agricultural Department in Washington, D. C., the admirable work of Mr. T. Glover. I was really astonished at going through this valuable collection. The plan upon which Mr. Glover works is his own, and the arrangement of his own devising. When fish, fruits, etc., cannot be preserved, excellent casts beautifully colored are made and exhibited. Plates illustrating injurious and beneficial insects and their transformations, drawn, engraved and colored with his own hand, are mounted in the halls, so that if any one wants to know about the insects injuring certain crops or plants, he can obtain very complete information. I know not which the more to admire, the extensive, really vast plan of the institution, and the elegant completion of the design, or the modesty of the learned naturalist who has conceived and done it all entirely without aid, in the agricultural interests of this great country; meanwhile supported by means really ridiculously small, compared with the results. I confess that the Agricultural Museum in Washington has no superior in the world, and even no rival either in England, France or Germany."

THE authorities of Brown University are beginning to form a museum of natural history. During the last year several additional large cases were placed in Rhode Island Hall, and between three and four hundred specimens of birds and animals were added to the previous collection. A large collection of the implements of American Indians was also added, together with several small though valuable collections of coins, both ancient and modern. The expense incurred by these improvements was met by a few friends of the College, interested in this department. Arrangements have now been made for adding to the Cabinet an extremely valuable collection of birds, numbering about forty-five hundred; and also such specimens in Mammalogy, Herpetology, Ichthyology, Conchology and Comparative Anatomy, as will meet the wants of instruction.

The mounting and arrangement of the specimens is entrusted to the care of Mr. J. W. P. Jenks, A.M., a well informed practical naturalist, and a most skilful taxidermist. Mr. Jenks was one of the party assembled by Prof. Baird, U. S. Fish Commissioner, at Wood's Hole, during the last summer, and spent six weeks in making full collections of the marine animals of that coast, so that this department usually so incomplete in our colleges, will be well represented at Brown.

AMONG the losses sustained by the burning of the Museum of the Chicago Academy of Sciences was that of "the State collection of insects, recently purchased by the State from the heirs of the late State Entomologist, Mr. B. D. Walsh, for two thousand dollars, but of great scientific value from the number of types it contained.

"The Smithsonian collection of Crustacea, undoubtedly the largest alcoholic collection in the world, which filled over ten thousand jars, and contained the types of the species described by Prof. Dana and other American authors, besides hundreds of new species, many of which were described in manuscripts lost by the same fire.

"The invertebrates of the United States North Pacific Exploring Expedition, collected in great part in Japanese seas by the Secretary in 1853–56, which, besides crustacea, included in the last item, embraced great numbers of annelides, mollusca, and radiata, most of which remain undescribed, except in manuscripts also lost.

"The collection of the marine shells of the coast of the United States, made by the Secretary and his correspondents during twenty years of dredgings and general research on every part of the coast from Maine to Texas. Nearly every species was illustrated by specimens from every locality in which it occurs, not only on our own shores, but on those of Europe and the Arctic Sea, and in the Tertiary and Quaternary formations, showing the effect of climatic influences, geological age, etc. This collection embraced about eight thousand separate lots of specimens.

"The deep-sea crustacea and mollusca dredged in the Gulf Stream by M. Pourtales, of the United States Coast Survey, in the years 1867, '68 and '69, which had been placed in the hands of the Secretary for description.

"The manuscript of the Invertebrate Zoology of the North Pacific Exploring Expedition under the command of Capts. Ringgold and Rodgers, in 1853–56; the shells by the late Dr. A. A. Gould; the Crustacea, Annelida, Nudibranchiate and Tunicate Mollusca, Holothurians and Starfishes, by Wm. Stimpson. These manuscripts were illustrated by nearly three thousand drawings by A. Schœnborn and W. Stimpson, many of which were colored. This material was awaiting an appropriation from Congress for publication. A portion thereof (that on the Brachyurous Crustacea) was

saved, having fortunately been in the Smithsonian Institution at the time of the fire.

"The manuscript of the work on the shells of the East Coast of North America, prepared for the Smithsonian Institution by W. Stimpson, illustrated by drawings not only of the shells, but of the soft parts, lingual dentition, ova-capsules and other details. This work had been in course of preparation since 1849, and many of the species illustrated were new to science. About two hundred of the drawings had already been engraved on wood, but the blocks were destroyed with the rest of the materials. That portion of the work containing the synonymy of the species already described was saved, having been in the house of the Secretary at the time of the fire.

"The manuscripts and drawings of a work on the Crustacea of North America, in preparation for the Smithsonian Institution by Wm. Stimpson. A series of "dredging papers," containing an abstract of the result of explorations by the Secretary on all parts of the coast from Nova Scotia to Florida, and in the Gulf of Mexico, chiefly valuable for the study of geological and bathymetrical distribution. The descriptions (as far as completed) of the deep-sea crustacea and mollusca dredged in the Gulf Stream by M. Pourtales, prepared by the Secretary. A portion of these descriptions had been published in the 'Bulletin of the Museum of Comparative Zoology.'"

BOOKS RECEIVED.

On the Position and Height of the Elevated Plateau in which the Glacier of New England, in the Glacial Era, had its origin. By J. D Dana. 8vo. pp. 8, 1871.

Maps of the Upper and Lower Geyser Basin, Fire Hole River, Wyoming Territory, and of the Yellow Stone Lake. From Surveys under the Department of the Interior. By U. S. Geological Survey under Dr. F. V. Hayden.

Preliminary Report on the Dredging in Lake Superior, under Bv't Brig. Gen. Comstock, U. S. A. By Sidney I. Smith. 8vo. pp. 8.

Monthly Report of D'pt of Agriculture for Nov. and Dec. 1871. [Contains "Entomological Record." By T. Glover, U. S. Entomologist.]

Algæ Rhodiaceæ and Carices Boreali—Americanæ. By Stephen T. Olney. Providence. 2 pamphlets 8vo. 1871.

Conchological Memoranda No. 8. By R. E. C. Stearns. San. Francisco, p. 1, 1871.

Bulletin of Museum of Comparative Zoology. Vol. 3, *No.* 3. *Letter concerning Deep-Sea Dredgings.* By L. Agassiz, pp. 5, 1871.

Annual Report of the Secretary of the Interior. Gov. document. 8vo pamphlet. 1871.

Report on the Geological Structure and Mineral Resources of Prince Edward Island. By J. W. Dawson, assisted by B. J. Harrington. 8vo. pp. 52. Map and 3 plates. Printed by authority of the Government of Prince Edward Island. Montreal 1871.

Descriptions of New Species of Birds of the Families Troglodytidæ and Tyrannidæ. By George N. Lawrence, pp. 5, 1871.

Catalogue of Crustacea from Panama collected by J. A. Mc Neil. By T. H. Streets. pp. 6, 1871.

Das Graberfe'dbei Gauernitz. By Dr. L. W. Schaufuss. 8vo. pp. 24. 1871. Dresden.

Jahresbericht der Naturforschenden Gesellschaft in Emden. 1870. 8vo. pp. 46.

Sitzungsberichte der Akademie der Wissenschaften, lxi Band. 1 Heft. 1870. 1st. and 2d abtheilung. 8vo. Wien.

Kieine Schriften der Naturforshenden Gesselschaft zu Emden. xv. 8vo. 1871.

Oversigt Kongelige Danske. Videnskabernes Selskabs Forhandlinger og dets Medlemmers Arbeider. 1870. No. 3. 1871. No. 1. Kjobenhavn. 8vo.

Verhandlungen des Naturhistorischen Vereines der preussischen Rheinlande und Westphalens. 1870. 1 vol. 8vo. Bonn.

Archiv fur Anthropologie. August 1871. 4to. Braunschweig.

Proceedings Academy Nat. Science of Philadelphia. Part 2, Apr.-Sept. 1871. (Jan. 1872.)

A series of papers on Conchology and Geology. By Isaac Lea, from the author.

Bulletin of the Torrey Botanical Club.

Journal of the Franklin Institute. Jan.

Amer. Journal of Science and Arts. Jan.

Land and Water. Nos. for Dec.

The Academy. Nos. for Dec. Jan.

La France Scientifique. Nos. for Dec.

Bowdoin Scientific Review. Dec.. Jan.

Le Naturaliste Canadien. Dec.

Nature. Nos. for Dec. Jan.

The Field. Nos. for Dec. Jan.

Science Gossip. Dec. Jan.

Newman's Entomolgist. Dec. Jan.

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THE BREATHING PORES OF LEAVES.

BY PROF. T. D. BISCOE.*

If the outer layer or skin be stripped from the surface of the green colored parts of plants and examined under a low power of the microscope, the stomata, or breathing pores, will appear as green specks in the otherwise colorless membrane. Their object is to open and close communication between the intercellular space always existing between the individual cells, and the outer atmosphere.

The sausage-shaped cells constituting the essential part of the organ are called the pore cells. They have the power of separating from each other in the middle, thus opening a free way for the air to the interior tissues; or in certain conditions of light and moisture they approach each other so as to narrow or entirely close the slit between them. They are filled with protoplasm, chorophyl and starch granules, while all other cells of the outer surface are filled only with air and water.

Apparently with the object of placing these pore cells as free as possible from all constraint or pressure, so that they may correspond sensitively to all the changes in the atmosphere, they are at times situated on a level with the epidermis cells, sometimes raised above, at others sunk beneath this level. If the epidermis cell walls are thin and flexible the stomata will generally be found in the same surface with them: but when the epidermis walls are thick and stiff the stomata will generally be found sunk deep un-

*Abstract of a paper read at the Troy (N. Y.) Scientific Association, Dec. 18, 1871.

der the surface, or raised above it, or surrounded by a ring of smaller cells with thinner walls than the remaining epidermis cells.

Immediately under the stomata are empty spaces, of irregular form and varying size, called breathing rooms. They are in connection with, and form a part of the intercellular space which ramifies through the entire structure of most tissues.

It is an interesting question, in what way the stomata have been formed. Were the pore cells at first a pair of ordinary cells, which have gradually changed their form and contents until endowed with all the peculiar properties of their natural state? Or were they always existent in their peculiarities, only smaller as the leaf was younger? Or, have they grown out of a single cell by the process of subdivision and after growth? Do they belong to the epidermis, or to the chlorophyl bearing tissues beneath? Two examples, studied in their structure and history, will throw some light on these questions.

Gasteria verrucosa, of the aloe family shows, scattered over the surface, small, thick-walled squares with a deep cavity in the centre (Pl. 3, fig. 6). These squares fall at the junction of four cells which are distinguished from the others by the absence of the little cone in the middle. In the centre of each square, at the bottom of its cavity, can be seen a narrow slit. Various sections will show more of the structure. Pl. 3, figs 7 and 8 represent thin horizontal slices seen from below; *i.e.* inverted on the stage of the microscope. The razor in fig. 8 has passed through the pore cells, and in fig. 7 just beneath them. In fig. 7 you see, shimmering through the green pore cells, the thick-walled square which was so plain in the surface view. The vertical sections, figs. 9 and 10, show the thick outer wall of the epidermis and the little cones or protuberances seen in the middle of the cells in fig. 6. In fig. 9 it will be perceived that the opening between the pore cells is not a plain straight-walled cavity, but that the two cells project in the middle, and again by means of horns or protuberances, come nearly in contact above and below, thus making as it were, a couple of little ante-chambers before reaching the great breathing room. The striped portion under the pore cell in fig. 10 represents a thickening of the cork layer which has formed there; it lies on a little lower plane than the rest of the drawing. The square cavities above the pore cells may be called the front yards of the stomata. When you drop a little of Schultz' Iodine so-

lution on a section like fig. 9 the thick outer wall of the epidermis, especially in the outer half, turns deep brown, a color which follows down the sides of the cavity, extends as a very thin layer through the slit, and fades out on the walls of the rectangle below; the substance thus colored is cork, or of the nature of cork. The main portion of the walls of the pore cells, and all the cellular tissue underneath, become violet or purple; the reaction of cellulose. The little grains in the cavities of the pore cells are of a bright blue, betokening starch; and the granular mass of protoplasm in which these are embedded becomes yellowish brown.

In studying the development of this complex organ, we take the youngest leaf of the plant, and find on its base (the youngest portion) no trace or hint of stomata. A very little higher up we find the epidermis appearing as in fig. 1, many of the cells having built a partition across their front end cutting off about a quarter of the original cells. These small cells are distinguished from the remaining portion of the originally single cells, and from the undivided cells, by being filled full of granular protoplasm while the other cells are only partially filled with the protoplasm constituting the nucleus. These little cells, called mother cells, soon grow so as to become longer than broad, and are raised by the more rapid growth of the surrounding cells so as to leave an air space below (figs. 2 and 4). An approach to a spherical form is now made by the mother cells, and the walls of the neighboring cells are a little thickened with the deposition of cork substance giving the first trace of the thick-walled square of the ripe stomata. Next the mother cell divides by the formation of a thin partition which runs in the direction of the point of the leaf, and is perpendicular to its surface. Soon this partition thickens in the middle (fig. 3) and splits through the thickened portions to within about a fifth of each end. All further growth only effects minor changes in the form of the cells, or an increased thickening of their wall. Figs. 4, 5, and 9 show the various stages of growth in cross section, and fig. 10 in longitudinal section.

In *Tradescantia discolor* the stomata, quite different in appearance, are more readily seen from the surface. (Fig. 14.) The peculiarity of these stomata consists mainly in the structure and form of the epidermis cells immediately around them and constituting a part of the stomata apparatus. The form and arrangement of these cells are shown in figs. 16, 17, and 18. The

double lines in fig. 14 between the "help pore cells," as these four surrounding cells are called, are formed by projections of one cell over another, as shown at *a* of fig. 17, which when seen from above would show two contours to the same cell nearly in the same plan.

The development of these stomata is easily traced in the figures. The mother cell, shown in fig. 11, grows less rapidly than the surrounding epidermis cells, whose walls therefore stretch out as radii from its four corners. Thin partition walls are thrown across between these radii cutting off from these side cells new cells as shown in fig. 12; at *a* one of these side cells having been formed, and two at *b*. Almost immediately afterwards a pair of end cells are formed in a similar manner; and after this formation of the four help pore cells, the two pore cells are formed as described in the *Gasteria verrucosa*. Figs. 15, 16, and 17 show in cross sections the development of these organs, and fig. 18 shows the mature state in longitudinal section. The air spaces do nôt exist at first, but the unequal growth of the surrounding tissues causes tension which splits apart the walls dividing the cells, and thus forms and enlarges the air spaces; and in the same manner are formed the openings between the pore cells themselves.

The two examples described may serve as types of two classes of stomata, in one of which the pore cells are surrounded by ordinary epidermis cells, and in the other by modified cells or help pore cells. Within these two classes are to be found stomata differing from each other as variously as the leaves in the two great classes net veined and parallel veined.

EXPLANATION OF PLATE 3.

Figs. 1, 2, 3. Surface views of epidermis of *Gasteria verrucosa*, from first appearance of the mother cells of the stomata to the production of dividing wall between the two pore-cells.

Fig. 4. Cross section of same stage as No. 2.

Fig. 5. Cross section, somewhat older.

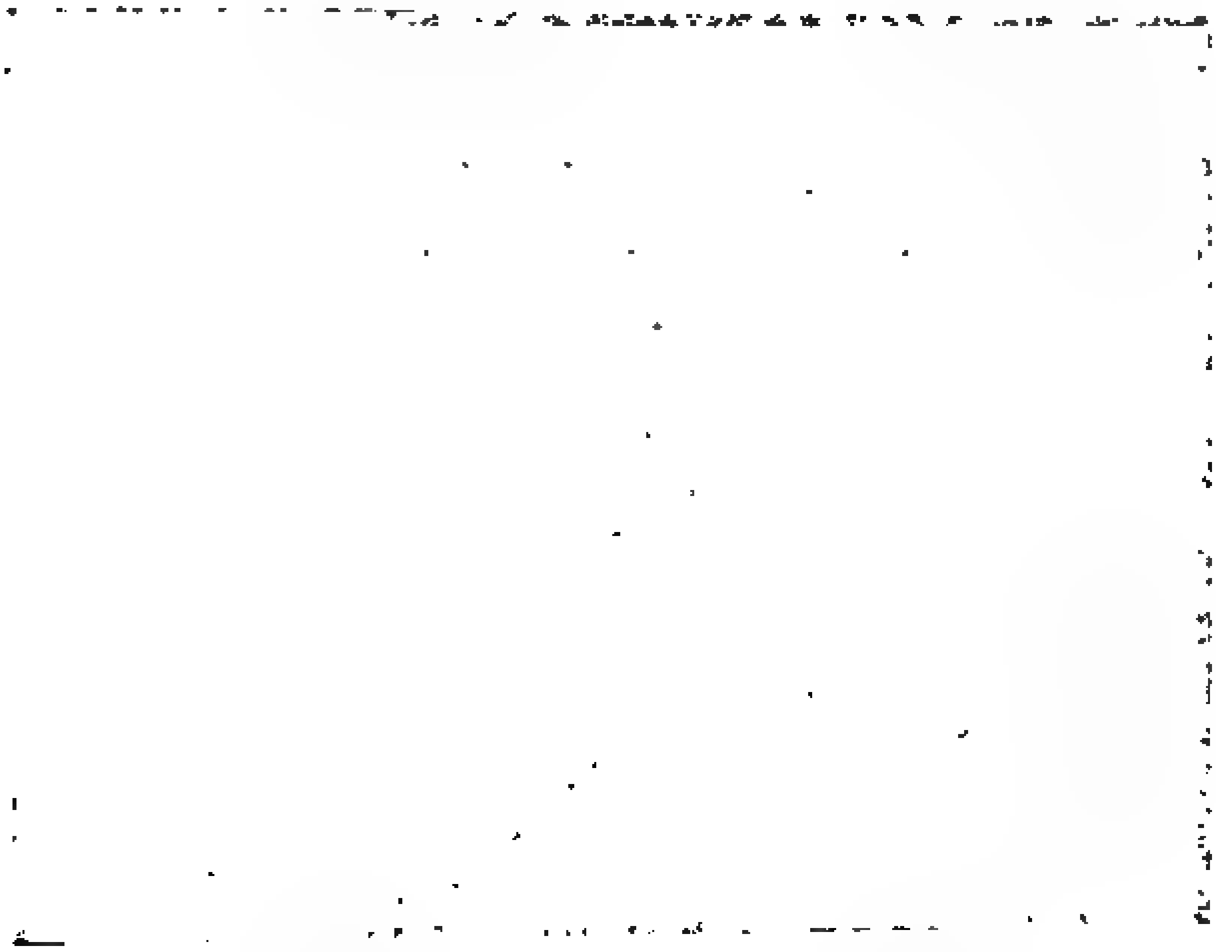
Fig. 6. Surface view of full-grown leaf, showing two stomata.

Fig. 7. Stomata fully grown seen from beneath, the plane of the drawing being completely under the stomata.

Fig. 8. Horizontal section of the same.

Fig. 9. Cross section of the same.

Fig. 10. Longitudinal section of the same.



BISCOE ON THE BREATHING PORES OF LEAVES.

Figs. 11-14. Surface views of epidermis of *Tradescantia discolor*, from first appearance of stomata to maturity of the same.
Fig. 15 Cross section of about the age of No. 12, *b*.
Fig. 16. Cross section of the age of No. 13.
Fig. 17. Cross section of full-grown.
Fig. 18. Longitudinal section of the same.
× 400. The arrows indicate the direction of the point of the leaf.

AQUEOUS PHENOMENA OF THE PRAIRIES.

BY PROF. H. W. PARKER.

The igneous scenes of the prairies have become very common place in description. But where is there any account, either scien tific or popular, of the interesting aqueous phenomena, in winter and in summer?

How it may be in the region protected on the north by the Lake Superior highlands and affected by the air of the lakes, the writer does not know, except that the temperature is much modified. But in central Iowa intense cold is of frequent occurrence, and there are conditions along with it that often bring out the splendors and wonders which we associate with arctic scenes. Parhelia, or mock suns, at morning or evening, are common; without exaggeration it may be said that they equal the real sun in brilliancy, and are indeed blinding to the sight. After witnessing them, an eastern man regards all that he has seen of this phenomenon at the east as insignificant. So likewise, mock moons, and both lunar and solar halos, crosses, and far-extending complicated circles of light, with bright spots at the intersections, may be mentioned as sights by no means unusual, and often of great magnificence and duration, continuing a good part of the day or night. The writer remembers, for example, a circle passing through the sun and reaching horizontally quite around the sky, making part of a cross inscribed within another circle around the sun, there being also four tangent circles at the ends of the cross; and this was visible for several hours before and after midday. The cloudless sky of the West conspires with spicules of frozen vapor, to render these effects not rare; for the West, at least beyond the vicinity of the lakes, is bright and sunny at all seasons.

Feathery crystals, frequently of great size and beauty, and completely clothing every exposed object, are sometimes to be seen

for a succession of mornings and would number many repetitions in the course of every winter. The writer counted a dozen fine exhibitions of this kind before one winter was half gone. In cold weather, a perceptible thin vapor comes on at night, not uncommonly, when the air has a stillness favorable to the growth of this icy leafage. In certain covered situations, where moisture rises, cobwebs are changed to a lace-work of crystals, the length and delicacy of which would be incredible to one who never lived in such a climate. In a cellar stair way, the plastering and shelf and every article on it were soon robed with a polar-bear fur of icy filaments, so long that the smaller articles lost their identity of shape.

It is well known that the fine porous soil of the West has a marvellous ability to support vegetation, during the long droughts that characterize the region. The cracking of the earth in a prolonged drought is wonderful, especially along the beaten surface of roads. Fissures over an inch across have been measured. How the subsoil can retain any moisture, with such openings down into its heart, is a mystery. On the high treeless rolling prairie, however, at the summit level between river systems, water is readily obtained at a depth of from fifteen to twenty feet, though not always in sufficient quantity. The manner in which wells are made for the supply of mills, in such a situation, is worthy of publication. A shaft is sunk, say thirty feet, and from the bottom galleries are drifted in various directions, in the style of a mine, sometimes to the length of a hundred feet. Thus, numerous very small veins are struck, which, all together, give a large supply of water. The workmen report these veins as occurring at somewhat regular intervals, and as indicated by a root-like mass of darker earth; it is affirmed, too, that they follow one general direction,—in one instance at least, said to be transverse to the surface drainage.

In this connection, reference may be made to the subterranean cryptogams that penetrate almost every inch of the deep, loamy gray clay beneath the top soil in that prairie region, and perhaps in all similar districts. This vegetation, threadlike or coarse stringlike, is coated with dark discolored earth, and is mostly dead, the thread lying shrivelled, black and loose in its cylindrical cavity; but the writer has found the filaments apparently fresh and living at a great depth — even to the depth of eight feet, if his memory is not at fault.

One very common peculiarity of the surface drainage may be

noticed—the extent to which the water of the sloughs, or swales, reaches up the acclivities on either hand, even where the interval has a very considerable descent in the line of flow; there is thus a broad concave bog that must strike a stranger with surprise, for it is not due to springs, but rather to a spongy retention of rainfall.

Some peculiarities of prairie storms should not be omitted in this sketch. Nothing at the West is done by halves; when it rains, *it rains*; and the general surface is so uniform, the soil to a certain depth so pervious, that something like a subterranean lake is suddenly formed, which rapidly rises, flooding cellars and even bursting up the cement of cellar floors by hydrostatic pressure, if cement has been resorted to, by the trustful immigrant.

One species of prairie storm should be elevated to the rank of a genus. It is mostly nocturnal in its habits and prowls all night; its distinguishing characters are surges of rain, rhythmic roar of wind like that of heavy billows on a coast, incessant quiver of lightning, and overlapping continuous peals of thunder. It is as if the spirits of the old American Mediterranean sea were claiming again their last battle-ground—a suggestion harmonizing with the ocean-like level of the country and the looming mirages of sunny days. But the lightning of this species of storm seems to be among the clouds, and the new-comer soon becomes fearless; indeed, it does not require a long residence at the West to make one familiar with lightning, however timid he may have been at the East, although it remains true that thunder gusts are not pleasant to a person who is out on the open prairie, where man or horse is the only prominent object to attract the downward or upward bolts of electricity. Finally there is something peculiarly grand in western thunder. No hills break its smooth roll, and its long crescendos and diminuendos give a breath and cadence to the sound, as if chariots could be heard rolling on for hundreds of miles over the level prairie floors.

The subjects of this article have not been in the path of the writer's special study; but he believes that the prairie region offers a fresh and interesting field of observation in this regard. The reports and books where the information might properly be looked for, have failed to give him any information in respect to the relative humidity of the prairie atmosphere—a matter of prime importance. On average winter days, the writer found it from forty to fifty hundredths of saturation.

REMARKS ON UNIFORMITY OF NOMENCLATURE IN REGARD TO MICROSCOPICAL OBJECTIVES AND OCULARS.

BY R. H. WARD, M.D.*

THE *nominal focal length* of an achromatic objective, as used by microscopists generally, represents its amplifying power as actually used in the compound microscope. Even the equivalency in amplifying power with a single lens of the same focus is no longer distinctly realized, while the size and appearance of the combination, its working focus, angular aperture, and microscopical efficiency, are not even hinted by the figures used. The nominal focus represents the magnifying power and those properties dependent on it. Like other measurements, these must be stated by comparison with known standards. To use diverse and unknown units of measurement in cases designed to be compared with each other is simply self stultification. To call two lenses, of identical magnifying power, respectively one-fourth and one-sixth inch lenses, is just as indefensible as to call two houses of equal height, forty and fifty feet high respectively. To argue against the existing looseness of usage in naming lenses, is only to state what everybody knows in regard to the advantages of uniform standards of measurement generally. So impressed are many microscopists with the urgency of this question, and so determined are they to escape from some of the present confusion, that a committee has been appointed to report on the subject. Though that committee is unprepared to report, it is believed that giving publicity to some facts and opinions involved in the consideration, may lead to useful agitation and to increased definiteness of ideas and of information in regard to it. Of course it would be premature to claim or expect accuracy of statement or safety of opinion in such a complication of disputed questions; and what is said, is designed to be contributory and suggestive, and in no degree dogmatic or final.

The great variation in objectives of identical name is familiarly

* Being the substance of remarks made by the writer at the Indianapolis meeting of the American Association for the Advancement of Science.

known and is undisputed. Among other people one-fourth of an inch is less than four-tenths and more than one-fifth; but among microscopists it may often be more than the first or less than the last. An indefinite number of figures might be published to prove or illustrate this irregularity, the writer having been particularly interested in making and recording these comparisons for more than a dozen years, and Messrs. Bicknell, Biscoe, Higgins, Cross, and many others having been especially interested in the same study; but it is idle to prove what everybody knows and admits. So familiar have some of these apparent errors become by use, and good usage too, that they have been often accepted as established, even one of the latest authorities* stating the power of the one-fourth-inch objective five times as high as that of the one-inch.

In the early days of the compound microscope as a really useful instrument, we find microscopists wishing that microscope makers would "grind their glasses to some settled standard."† We are willing to be more reasonable now, or else the conditions stated have become more difficult. We do not desire, nor consider it practicable that the opticians should make all their combinations of certain definite and conveniently graded powers; but we do propose so to name our powers, if we can, that each number shall group together all those powers of which it is the nearest and best description.

Makers would doubtless be considered as doing a favor to those who use their instruments if they would, after finishing lenses, carefully estimate their powers and name them by the fractions most nearly representing those powers. But even if this were done, and much more now when this is certainly not done, or not done upon such a uniform plan as to be satisfactory, microscopists should always reëxamine their lenses in order to be definitely informed in regard to one of their most important properties.

The easiest method of examining the *magnifying power* of an objective, by measuring the image (of a known object) which it forms at a standard distance (now ten inches), was as well understood a hundred years ago as now; a lattice of fine silver wire or of human hair, or a scale ruled on glass, being used to measure

* Suffolk, Microscopical Manipulation, London, 1870.

† Baker on Microscopes. London. 1742.

the image.* A positive ocular† or the eye-lens of a negative one is used as a simple microscope with which to read off the measurement. If a separate piece of apparatus were to be made for the purpose of measuring these powers, a positive ocular with micrometer attached would doubtless be preferred, it being placed by means of the drawtube or some other contrivance at such a height that its micrometer should be ten inches from the objective. Its reading would then give the real size of the image formed at that distance by the objective, and the ratio of this number to the known size of the object, say the distance apart of two lines on a stage micrometer, would give the magnifying power of the objective. But as few are possessed of a large variety of apparatus, or care to buy a piece for so infrequent a use as this, the measurement is generally made with an arrangement which every microscope ought to include, a negative ocular with a micrometer in the focus of its eye-lens, whose advantages for general micrometry are so well understood, giving the best view of the object and a sufficiently good view of the measuring lines, that it is usually preferred for that purpose. Of course the field lens is removed in measuring the power of the objective alone,‡ but replaced for ordinary work. If it should be thought best to name lenses by their magnifying power alone, the power ascertained could be at once attached to the lens, the present one-inch lens becoming No. 10, or x 10:§ but if it should be the usage to name it by its power when combined with some standard (say two-inch) ocular, it would be marked No. 50, or x 50, or perhaps x 45 or x 55. Should it be preferred to retain the nomenclature by inches of focal length, a power of ten diameters might be called a one-inch lens, and powers above and below rated in proportion. This plan is within reach of the opportunities of every microscopist, while the plan of actually employing a single lens of small aperture and exactly one-inch focus as a standard of comparison is only adapted to the use of

* The measurement of the image, formed by the objective only, on a screen at a distance of several feet, as employed by Dr. J. J. Woodward at the Army Medical Museum at Washington, is unquestionably the most reliable method of determining the amplifying power; but is a method which requires too many applications and too much skill to be universally applicable.

† The convenience and growing popularity in this country of this continental term suggest the propriety of its general substitution for the awkward name eye-piece.

‡ Dr. J. J. Higgins in the American Naturalist, Dec., 1870, p. 628.

§ It might be 9 or 11, and thus the various degrees of power would be conveniently expressed.

the opticians and is not free from question as to what standard is meant after all. The lens made as a standard is probably not a one-inch lens at all (principal focus), for the principal focus is never used in the microscope; and authorities differ as to whether it should have conjugate foci of one-inch and ten inches, or ten inches apart (one-inch and nine inches). Assuming x 10 as a one-inch power, would be most easily applicable and unmistakable; and this power, ten, divided by the ascertained power of any ocular or objective would give the equivalent focal length of that objective or ocular without comparison and beyond dispute.

The chances of error in this case are the same as in ordinary micrometry, with one or two additions, and should in all cases be ascertained in order to test the reliability of any series of observations. They are due to the uncertain value of the divisions of the stage micrometer, to the like (but less important) variability of the measuring scale, to the uncertainty as to the exact optical correspondence of the lines selected for comparison in the two scales, and to the uncertainty as to obtaining exactly the assumed distance between the upper scale and a given point of the objective. The first of these errors is the largest, and its magnitude would surprise many who have noticed and admired the remarkable "perfection" of the common micrometers. A micrometer which ought to be the best in the writer's possession, with lines 100, 1000 and 2000 to the inch, has a certain error of .02 and a limit of error of .035. This is entirely too much latitude for a single source of error, and of course it is nearly eliminated by comparing a large number of spaces belonging to at least several different scales, rejecting any scales which by differing widely from the average standard are presumably erroneous, and averaging the rest. The remaining sources of error may be similarly reduced by averaging, though their aggregate limit of error, ascertained by comparing the average measurements with extreme figures beyond which there is no possibility of doubt, will be found to be very small and inconsiderable.

The standard *distance of measurement* in estimating magnifying powers may be stated to be, at present, ten inches. The distance of five inches has been recommended, even somewhat recently,* and eight,† nine,‡ and ten § inches have been successively used.

* Brocklesby. N. Y., 1851.
† Baker, Lond., 1742.
‡ Martin Fokes, Esq., P.R.S., 1742.
§ Lardner, Carpenter, Suffolk, etc.

The smaller numbers were evidently too small, and the last, ten inches, seems to be permanently accepted as most correct theoretically and most convenient in use. If, however, the metric system were to come into general use, this distance would be changed to two hundred and fifty millimetres with increased convenience and with a scarcely appreciable difference in results. The sooner such a change is made the better, provided it is certain to come at all, and possibly it might be considered only a fair concession to the convenience of the great number of continental microscopists, and to the excellence of their metric system, to make this change without further delay.

The propriety of measuring the image at this standard distance, when estimating the power of objectives or oculars is undisputed, and it would seem equally undisputable that the whole power of the compound microscope should be obtained in the same manner, were it not that the authorities have always differed in regard to the subject. When Hooke, Griffith, Hogg, and other eminent authorities have directed that the image should be measured at the distance of the object on the stage, and Lardner, Carpenter and Suffolk, in common with most microscopists, measure the image ten inches from the eye wherever the object may be, it is useless to appeal to authorities. It would seem, however, that the former direction, to measure the image at the distance of the object, must be an advertency which could lead only to confusion. The writer has fully stated this question in a recent review,* and therefore omits further discussion of it here.

A more difficult question is as to the *point in the objective from which the measurement should be made.* If the objective had an optical centre and we could find it, there would be no difficulty in the case. But the modern objective has no permanent optical centre, at least none that we can easily find and use, and unless some one can give us a better rule, we may be obliged to measure from the bottom of the whole system, or from (about) the centre of the lowest pair or set of lenses. Mr. Charles R. Cross† has proposed to evade this difficulty by measuring ten inches between the conjugate foci used, without regard to the position of the objective; a plan which would be very eligible with high powers, but inconvenient if not inapplicable with low powers, since few compound

* The American Naturalist, June, 1871, p. 229.
† Boston, 1870.

microscopes have a body short enough to bring the conjugate foci within ten inches of each other with very low objectives, and, if they did, the magnifying power, instead of being that generally used, would be greatly reduced or altogether suppressed.

The very low power objectives (say four and five-inch) are usually mounted short in order to leave sufficient room between them and the stage, and their power as ascertained by an arbitrary rule, would be greater than that at which they are usually worked, unless, in their ordinary use, the draw tube were habitually raised enough to compensate for the shortness of their mounting.

At what point of *screw-collar adjustment* the angular aperture and the magnifying power should be computed, is one of the most complex questions involved in the discussion, and an entirely unsettled one. Most makers state the angular aperture of their lenses at its highest point, but no such uniformity of usage exists in regard to their magnifying powers.

With the lenses of a dozen years ago this would be comparatively unimportant, but with many of the high-power and high-angle lenses of the present day, the effect of the screw-collar movement is too great to be disregarded. It has been proposed, and would be most easy, always to rate objectives at their arrangement for uncovered objects, this being a naturally fixed point, and the only one at which the maker's judgment in regard to the accuracy of the correction is usually known: but this usage would greatly underrate many of the high objectives. On the other hand, rating them at their highest adjustment, or at an average between the two, might be vitiated by the fact that the point of highest correction is not a natural and fixed one, but is somewhat dependent on the judgment or caprice of the maker, some lenses of equal power being capable of a much larger range of corrections than others are. And finally, if we could agree upon some standard thickness of glass, and the glass were sufficiently uniform in refracting power, the same standard would scarcely be convenient for all powers (low powers being generally worked by the great majority of microscopists through glass, say $\frac{1}{100}$ or $\frac{1}{125}$ inch, for which many high powers are incapable of good adjustment), and few microscopists are sufficiently expert in the use of the screw-collar to make the same adjustment from the same glass-cover. Adopting the highest point of adjustment would perhaps involve the least change from present usage; and in cases of unusual interest or

importance it might be well to give both extremes, or else to specify the angle and power at which the combination was worked to accomplish the results specified. Attention need hardly be called to the fact that this great increase of power and angle, amounting sometimes to more than one-half of the minimum amount, is due entirely, not to the interposition of the cover-glass or other medium, but to the change in the relations of the lenses caused by the movement of the screw-collar. Where an extra front of different properties is added, we have essentially another objective whose power and angle should doubtless be separately stated.

The use of *linear measurement* in recording and stating powers has become so general that there may now be said to be no respectable deviation from the custom. In the early history of microscopy, powers were generally stated, according to the visible flatness or depth of the object, in superficial or cubical measure and it was plausibly urged that this represented the real, visible enlargement of the natural object; but, aside from the inconvenience of the large and often incomprehensible numbers thus obtained, this method gives in one sense the magnifying power, but in no sense the microscopical power employed. The power to see small things depends, so far as real or apparent size is concerned, on the distance from each other of minute points of structure, and this is in the exact ratio of the linear magnifying power. Squaring or cubing this power has acquired a suspicion of sensationism, if not of charlatanism, and is generally avoided in science.

If anything could be more confused and confusing than the different real and nominal powers of the objectives, it would be the corresponding powers of the *eye-pieces* or oculars. Made without any pretence of uniformity, and named without any serious attempt at significance, it has seemed until recently that no escape from the confusion was to be looked for. Yet it would seem to be convenient and altogether unobjectionable to have the oculars so named as to express their magnifying power, and the practice of doing this has been already introduced into this country. Some microscopists have re-named their oculars by their magnifying power, on the basis of one-inch to ten diameters, and I am informed by Mr. Bicknell that Tolles has already adopted the same plan, in naming those of his manufacture, discarding the letter nomenclature (A, B, C, etc.) and selecting 2 in., $1\frac{1}{2}$ in., 1 in., $\frac{3}{4}$ in., $\frac{1}{2}$ in.,

$\frac{4}{10}$ in., and $\frac{1}{4}$ in., giving powers of 5, $7\frac{1}{2}$, 10, 15, 20, 30, and 40 diameters. The writer has applied the same names to his oculars, applying the intermediate fractions $\frac{8}{10}$ in.. $\frac{2}{3}$ in., and $\frac{1}{3}$ in., to intermediate powers; and he is satisfied, by experience of its convenience, that this nomenclature only needs a trial, to secure its adoption by all who use the microscope for other purposes than amusement. Of course any microscopist, having determined the power of an objective and the powers of the microscope when that objective is used with his various oculars, can obtain the powers of his oculars by dividing the latter numbers by the one first named, and can then name his oculars, like the objectives, either by their magnifying powers or by their equivalent focal lengths. The rivalry of makers and the interests of trade are not involved in this case as in that of the objectives, and there may be no reason why this plan, if as acceptable to microscopists generally, as it has been to a few, should not come into immediate use.

In order to work the objectives and oculars at their standard powers they should be of course, about ten inches apart either by length of compound body or by use of draw tube; and it is believed that most objectives whose corrections are accurate enough to show any difference will work best at about this distance. Should a decidedly different distance be used in any observations of importance, it would be well to state that fact in recording the observation.

In reviewing this subject, the following *points* would seem to be reasonably well *settled*. Objectives should be, and could be to a much greater extent than they now are, rated according to a uniform standard. They should be named not arbitrarily, but in a manner indicative of their magnifying power. Ten inches is the standard distance of measurement in estimating powers. This distance should be taken from the eye to the rule by which the measurements are made, without regard to the distance of the object on the stage. Magnifying power is always stated in linear measure. The magnifying power and angular aperture, as well as the maker's name, should be engraved on all objectives, and added to all particularly important drawings made by their means. Oculars should be named, like the objectives, in such manner as to indicate their magnifying powers or equivalent focal lengths.

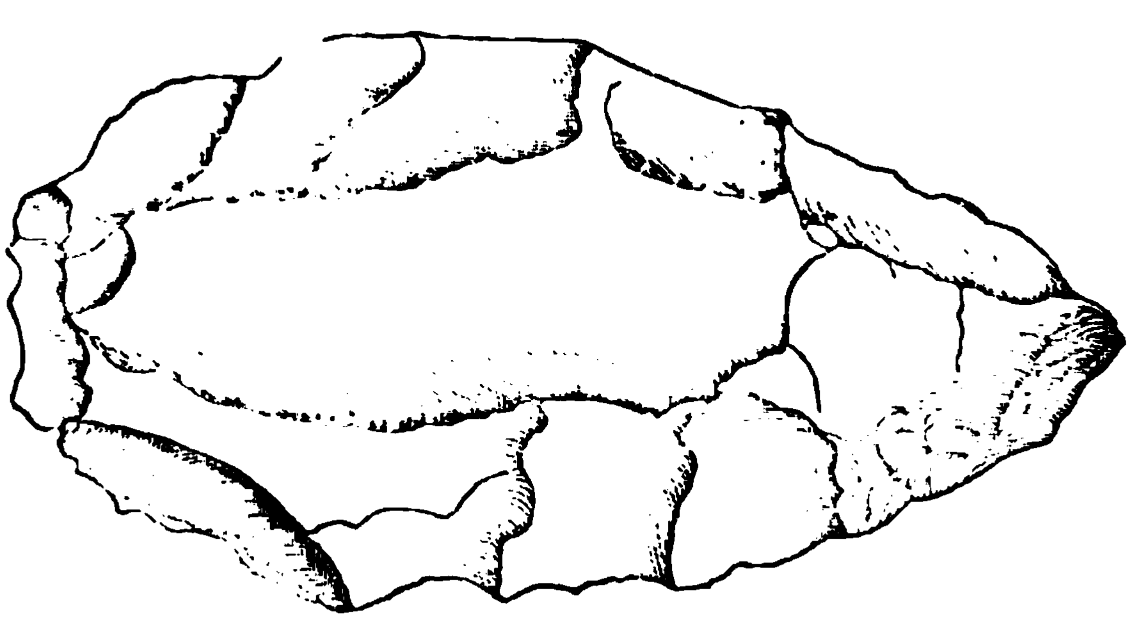
The following are some of the more important *queries* which still remain *open*. Should the standard one-inch objective be charac-

terized by magnifying ten diameters as used in the compound microscope, or should it be compared to a simple lens of actually measured focus or foci? Should the objective be named by its equivalent focal length, or by its amplifying power, or both? Should our standard distance of measurement be changed from ten inches (254 millimetres) to nine and five-sixths inches (250 millimetres)? From what point in the objective shall the distance to the scale be measured? At what point of screw-collar adjustment shall the objective be placed for rating its angular aperture and amplifying power? Should the name *ocular* be substituted for "eye-piece" in general use?

THE STONE AGE IN NEW JERSEY.

BY CHARLES C. ABBOTT, M.D.

Fig. 9.



1-2 natural size.

There are many people still living who remember the Indians in New Jersey, the last remnant of the once mighty tribe, the Lenni Lenape; and to-day scattered all over the state, from the mountains of Sussex to the sea-beach of Cape May, are to be found stone weapons and implements, popularly considered as once the property of these aborigines, and by them fashioned in all the varied shapes, sizes and of the various minerals that we now find. Axes, arrow-heads, lance-heads, javelins, harpoons, spears, knives, scrapers, hammers, adzes, mortars and pestles, pipes, amulets and puzzling shapes of chipped jasper; all these, in varying numbers are

yearly turned up by the plough, gathered as "curiosities," or momentarily gazed upon and thrown aside to turn up again, more broken than before, and so more a puzzle to him who finds them. Again, at odd times, a "deposit" is met with, deep in the soil and a neighborhood may have the even tenor of its way disturbed by the wise comments of village sages, who ponder gravely over the "injine things" and never think to preserve them. A record of a number of these "finds," however, has put us in possession

Fig. 10.

1-2 natural size.

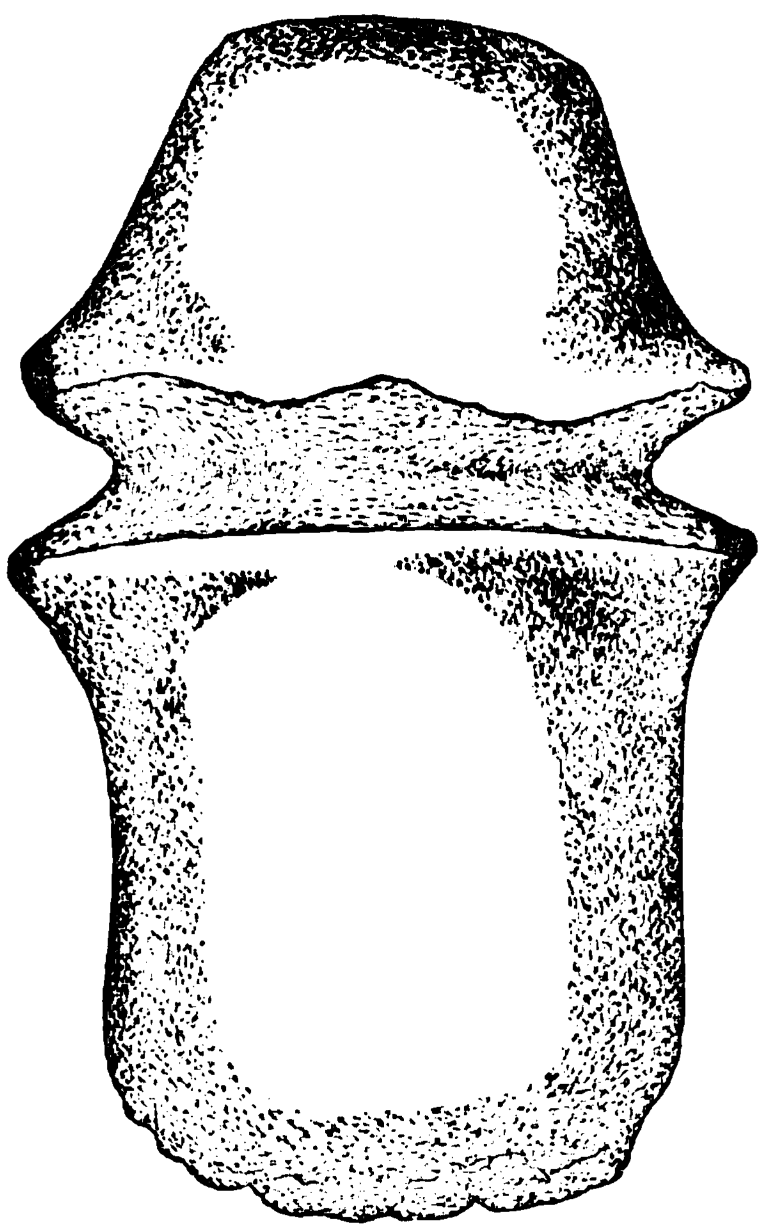
Fig. 11.

1-2 natural size.

of this fact, that the banks of our rivers and larger creeks were the favorite localities of these people of the stone age,—these Indians, if you choose — a people who had at no time a knowledge of metals, unless perhaps they utilized the many masses of native copper, which even a century ago were still to be found in some localities (neighborhood of New Brunswick, Middlesex and Somerset counties). There are yet savages in their stone age; and it was not many centuries ago that a people along the Delaware River fashioned from its sandstone and porphyry peb-

bles the weapons and implements their primitive wants suggested. These "relics" are now (with exceptions to be mentioned hereafter) surface-found specimens; but when a hundred or more are gathered together and carefully compared, we must come to one of two conclusions; either that there were many execrable workmen among their tool makers; or that the age of the crude specimens far exceeds that of the finely wrought relics. Compare the rude implement (Fig. 9) and the finely polished axe (Fig. 15). Both of these were found on the surface, yet we can scarcely imagine that a people who could fashion the latter, would deign to utilize the former. Take a series of whatever class of relics you may, there is always a gradation from poor (primitive) to good (elaborate), which is an indication, we believe, of a lapse of years from very ancient to more modern times, from a palæolithic to a neolithic age; and long after the introduction of metals, the choicer stone weapons were probably retained, and new ones continually manufactured. Arrow heads of stone, we know, are still in use. If this surmise be correct, if a people as rude as they who fashioned the wrought flints found at St. Acheul, near Amiens, France,* once dwelt on the shores of the Delaware, and the relics are as rude as those mentioned above, were not such a people too primitive to wander from another continent? We believe this and consider the first inhabitants along our Atlantic coast and inland to have been autochthones,† and that *their* "flint chips" are now found

Fig. 12.



1-2 natural size.

* Nilsson on the Stone Age. Edited by Sir J. Lubbock. Page xix, fig. 2. 3d Ed. 1868.

† We judge of our "Indians" by those relics that are now the only trace of their former existence, and finding stone implements as rude as those of Abbeville and Hoxne (see Lubbock's Prehistoric times), we naturally conclude that the fashioners of such "flints" were so primitive as to be incapable of a migration from Asia, and

mingled with the more elaborate stoneware of their descendants; the so-called Indians of to-day.

Having made a collection of these stone implements and weapons, it was natural to attempt to classify them at once, and when we speak of things so dissimilar as axes and arrow heads, it seems strange that there should be any doubt at times, whether any particular specimen should belong to one class or the other; yet we have met with such specimens, and our cabinet contains an unbroken series from the latter to the former, from triangular arrow heads, whose three sides scarce measure an inch, to jasper hatchets(?) a foot in length; and these hatchets run as gradually into axes, as the arrow points cease to be such, and are javelins, lance heads, harpoons or spears, as fancy dictates.

Fig 13.

Natural size.

through a country so bleak as to offer no inducement to leave a more congenial climate. However, the Esquimaux seem to be contented where they are, but they are a very different people from the so-called "Indians." We cannot but think that there was an autochthonic people here in North America, and if an Asiatic people migrated hither, they drove away or absorbed the primitive race that utilized such rude implements, as one especially, that we have figured. We do not hesitate to state such to be our belief, notwithstanding we find Baron Bunsen saying, "The linguistic data before us [speaking of Schoolcraft's work on Indians], combined with the traditions and customs and, particularly, with the system of pictorial mnemonic writing (first revealed in this work), enable me to say that the Asiatic origin of all these tribes is as fully proved as the unity of family among themselves." Sir John Lubbock says (Origin of Civilization; Amer. ed., p. 345), "It is my belief that the great continents were already occupied by a wide spread, though sparse, population, when man was no more advanced than the lowest savages of to-day, and although I am far from believing that the various degrees of civilization which now occur can be altogether accounted for by the external circumstances as they at present exist, still these circumstances seem to me to throw much light on the very different amount of progress which has been attained by different races." That is the migration from Asia that Bunsen claimed has absorbed the preëxisting race, but has not obliterated all traces of such autochthonic people,—we say autochthonic, but if all mankind sprung from some catarrhine ape of the Old World, a migration to America must have occurred; but this is going so far back into the past, that the relative positions of continent and ocean may have been widely different from what now exists, or existed when Bunsen would date the Turanian migration from Asia.

The large jasper implement or weapon, fig. 22, may have been a hatchet, lance head or skin dresser, for that matter, and the works and figures of ethnologists do not help us much in deciding. It would be a great gain to the subject, had each of these various forms of "flint implements" a representative in the tools and weapons of some savage race now living. Such not being the case, however, conjecture must go a great way in deciding upon their use, and so suggest names by which they shall be known. With these prefatory remarks, we will now undertake a classification of the collection, upon which the remarks in this article are based; commencing with the large grooved and polished stones, popularly known as

Fig. 14.

1-2 natural size.

AXES. — For convenience of description, we will separate our "axes" into two classes, axes proper and hatchets; the former being a water-worn stone that is provided with an edge and blunt back; grooved or not grooved. for a handle; and the latter being cutting implements of one or more edges; without any hammer-like part, having been always broken from a mass of flinty rock and chipped into the desired shape.

We will now again divide the axes proper into grooved and

not grooved,* and illustrate the various shapes that occur in varying numbers. A majority of the axes found in New Jersey are water-worn pebbles of sandstone, porphyry, granite, serpentine, etc., that have originally borne more or less resemblance to some one of the shapes then in use. Such cobble stones are usually grooved, on each side and beneath, and the stone worn smooth upon the upper edge (Fig. 10), which is a common shape; or the groove circles the stone (Fig. 11). In a number of specimens, the original surface of the stone has been ground or chipped away from the groove making it a more marked feature in the implement (Fig. 12). This specimen has had considerable work put upon it, as is seen by the general elegance of the outline. There is no indication of its having once been polished; and the edge, which is now mutilated, was probably never very sharp. As a rule, these cobble stone axes are not polished except upon the edge; the axe (Fig. 10) and the beautiful specimen (Fig. 15) being exceptions. In size, axes of this description vary very much, the little specimen (Fig. 13) being but three inches in length by two in breadth, and is the smallest grooved example that we have. It is of sandstone, and a repetition in outline of the more accurately made specimen (Fig. 10). On the other hand, the uncouth axe (Fig. 14) is an example of the maximum size of this style. While this specimen, unquestionably, is an axe, it is of such rude workmanship, that we can scarcely imagine any man so primitive, as to be willing to make use of it. Its greatest length

Fig. 15.

1-2 natural size (side view). 1-2 natural size (end view).

*We will not include perforated stone axes in our description. That they occur occasionally in New Jersey is probable from the fact of other perforated stones occurring, but we have never met with a specimen.

is eight inches; greatest width five inches. In thickness the stone varies little from two inches. The cutting edge has been broken off too much to determine if it was ever very sharp or not. The grooved axe (Fig. 15), found in Salem county, New Jersey, is the handsomest specimen we have ever met with. As will be seen in the drawing, it has a second slight groove or depression in front of the main one intended for the handle fastenings. The whole surface has been beautifully polished, the edge is still perfect, equidistant from each side, and describing a very nearly accurate circle. Comparing such beautiful workmanship as this with the rude axe (Fig. 14) we can scarcely believe men of the same day and generation used them both.

Fig. 16.

1-2 natural size.

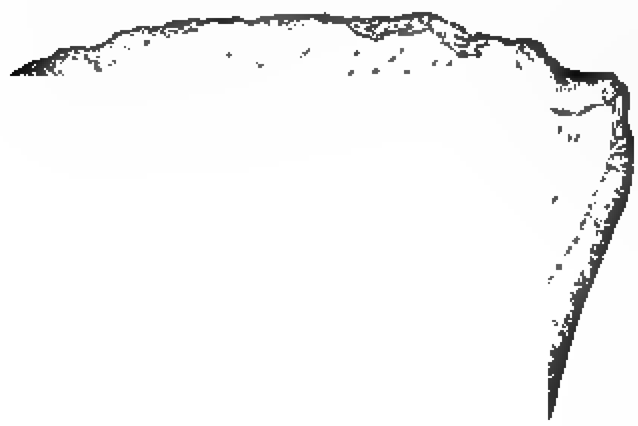
We will now take up axes without grooves, and find at the outset that they are neither as numerous nor as varied in outline as the grooved, cobble stone specimens. Ungrooved axes, however, are more generally polished, have better defined edges, and usually the end opposite the cutting edge is more or less pointed. The specimen (Fig. 16) is typical of the great majority of smooth, ungrooved axes as found in New Jersey. They vary but little from this in shape or size, some few being but one half its length and the back tapered to a rather sharp point. The dimensions of this specimen are: greatest length, six inches; greatest width, scant three inches; thickness in centre, one inch and a half. Occasionally, an axe of this shape was chipped out, and the beautiful mass of many colored jasper (Fig. 17) is an illustration of this fact. Rough in outline as it unquestionably is, its intended use is unmistakable. As the chipped edge extends beyond the end, both above and below, it may be that it should have been classed as a hatchet. It forms a good connecting link between these two forms. Of small axes we have three fine specimens that present a good idea of the prevailing styles of small weapons. The axe (Fig. 18) is of por-

Fig. 17.

Natural size.

phyry, and has been very carefully chipped and ground from a water-worn pebble such as are now so very abundant in the bed and along the shores of the Delaware River, at and below Trenton, N. J. Prof. Nilsson (vide "Stone Age in Scandinavia") would call this specimen a wedge, undoubtedly, and such may have been its use. It certainly does not appear to us how a handle could have been attached to it; but its cutting edge, which has been sharp, has induced our calling it an axe. Its length is about two inches, and its breadth two and one-quarter inches; its thickness at the commencement of the polished surfaces one and three-eighths inches. Another small axe, of rare shape, is that figured next (Fig. 19). It is of a fine grained porphyritic stone and has been polished over its whole surface. Its dimensions are nearly the same as the preceding, though it is not quite as wide as the former. The cutting edge was originally good. The back has a ridge running obliquely across it, from which the surfaces slope at angles of forty-five degrees. Had this been used as a wedge for splitting wood, certainly the back is not favorably fashioned for receiving a hard blow; and the ridge, which in that case would have been much battered, in this specimen is still in moderately good state of preservation. This double faced condition of the backs of axes is not unfrequent among the

Fig 18.



Natural size.

Fig 19.

Natural size.

grooved cobble stone specimens. A third specimen of diminutive axe is that given in Fig. 20. It is of a chocolate colored slate not commonly found in use among our antiquities. It has been very carefully polished and probably had a fine edge. Its size varies little from the preceding, and its general appearance rather indicates it as an ornament, "a victory stone or charm," rather than a weapon. They are not uncommon, and sometimes occur of a somewhat smaller size. Lastly, we figure (Fig. 21) a very rude axe or that and hatchet combined. As will be seen by the illustration, it presents many points of resemblance to both a hatchet proper and a spear head. That it is not the latter, however, is evident from the fact that the base, being the natural surface of the stone, is uncut, and sufficiently broad to enable the specimen to stand upon it on a level surface. The cutting edge being on both sides and running into an obtuse point, gives some points in common with a hatchet. It is, perhaps, even more than the jasper specimen (Fig. 17), a connecting link between axes and hatchets, and to these we will now direct our attention.

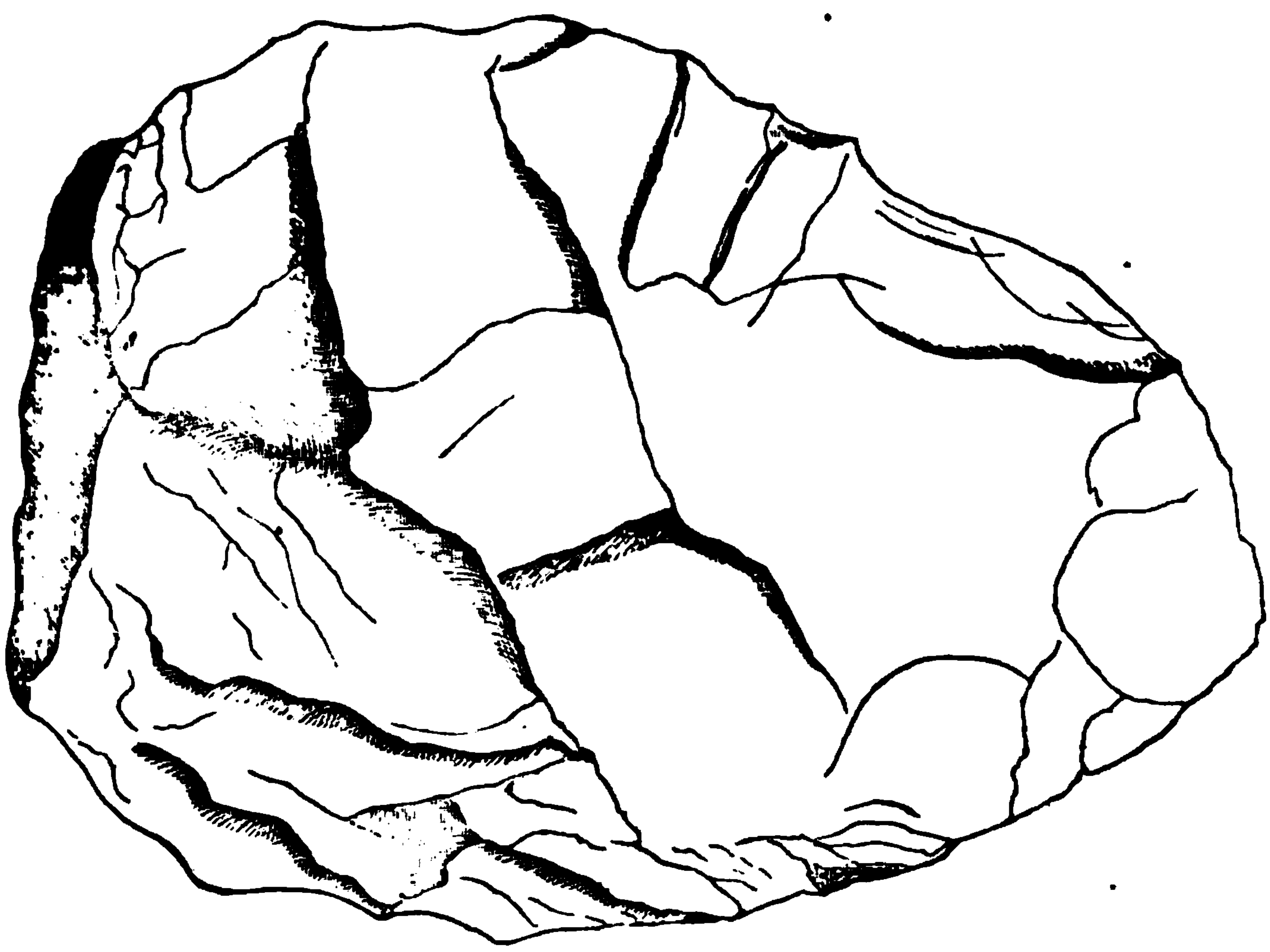
Fig 20.

Natural size.

HATCHETS. — What we here designate as hatchets, as distinguished from axes, are carefully cut jasper specimens, having no blunt edge with which to give or receive a hammer-like blow. They are usually smaller than axes and vary less in shape. Before going into details with reference to the jasper specimens, we will mention the crude hatchet (Fig. 9) and ask a comparison of it with the plate of a flint instrument given by Lubbock in Nilsson's "Stone Age." (See foregoing foot-note.) We consider this a very ancient "implement," and it is one of several that rolled out of the gravelly bluff that skirts the Delaware River near Trenton, N. J. Having no blunt edge, we call it a hatchet, and from it have in succeeding years been evolved, through accumulated skill, the more elaborate specimens. Prominently in this list stands the magnifi-

cent brown jasper specimen (Fig. 22). There we have a carefully chipped hatchet, well edged on all sides, of a nearly perfect oval outline. Its greatest width three and three-quarters inches; greatest length, six inches; and scant three-quarters of an inch in greatest thickness. This specimen is one of one hundred and fifty that were discovered in ploughing a piece of newly drained meadow near Trenton, N. J. The one figured is somewhat shorter and broader than the others, which might have been hatchets or lance heads.* They were buried points up, and were surrounded by a sufficient number of them to wall in and hold the erect ones

Fig. 21.



Natural size.

in position, had they been placed at the time on the surface. It is a little curious that we have as yet met with no isolated specimen similar to those in this "deposit." The bulk of the collection was presented to the Philadelphia Academy; and after many were stolen from that institution, the remainder were deposited for safe keeping with the American Philosophical Society, where they now are. Figures 23 and 24 we have also designated as hatchets, although the specimen (Fig. 24) is marvellously like the Esquimaux scraper, as figured in Sir John Lubbock's "Prehistoric Times" (3d ed., page 93, figs. 105–7), though just double the size; but

* Abbott on "Lance heads," in Proc. Acad. Nat. Sci. of Philadelphia, 1863, p. 278.

Fig. 22.

Natural size.

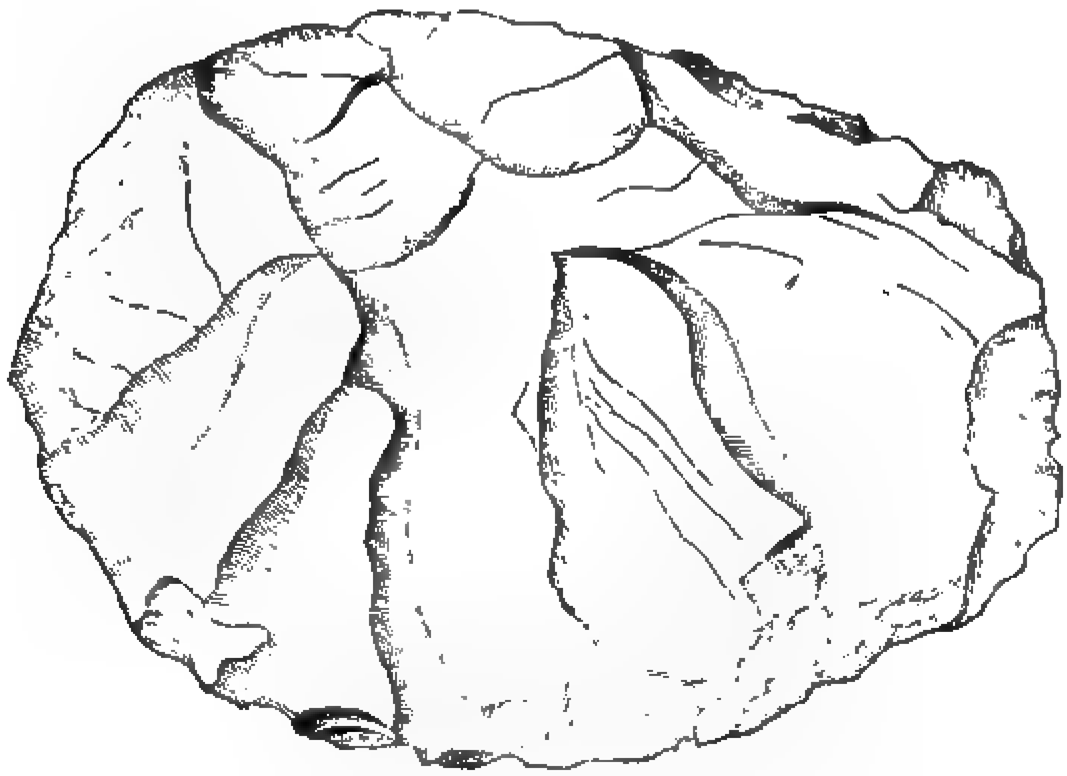
there is just this difference between modern or prehistoric scrapers and the implements we here designate as hatchets, *i.e.*, that the former have one flat, smooth surface, the plane of a single cleavage, the split of a single blow; while the hatchets have an edge, bevelled from each side, which are both equally well and uniformly chipped. These more elaborate "hatchets," however, may have been used as scrapers. The more usual sizes of hatchets are those illustrated by figures 25 and 26. These give the average outlines also of a series of nearly thirty gathered from one field. Their size should be no objection to the proposition that they were used as cutting tools. We have already seen that axes are equally small. Lubbock figures one from Ireland, in "Prehistoric Times," fig. 98, which is as small; and on page 182, speaking of Swiss axes, says, "with few exceptions they were small, especially when compared with the magnificent specimens from Denmark; in length they varied *from six inches to one*, while the cutting edge had generally a width of from fifteen to twenty lines;" and again on page 93, speaking of so-called "axes" or hatchets of the Kjökkenmöddings, says "they are . . . . rudely triangular or quadrangular in shape, with a cutting edge at the broader end, and two and a half to five and a half inches in length, with a breadth of one and a half to two and a half inches." Now the New Jersey specimens differ only in this, that both sides are chipped, but otherwise they are identical. As we have abundant reasons for knowing that mussels were a favorite food, they may have been used to crush their shells, having been found with heaps of half burned musselshells; and certainly, inserted in a handle by securely fastening the smaller or tapering end therein, they would make a formidable weapon. A tomahawk, for instance, to be worn in a belt and used in close combat, when the bow failed or the quiver of arrows was exhausted.

Fig 23.

Natural size.

In conclusion we would call attention to the rude green jasper hatchet (Fig. 27), that has an edge derived from a large chip

Fig. 24.



Natural size.

having been struck off, giving on one side a smooth surface, which edge meets with the opposite more gradually wrought surface. This specimen agrees more than any we have seen with the Kjokkenmödding axes; and we call attention to the similarity of our specimen with that figured in "Prehistoric Times," plate 1, fig. 8.

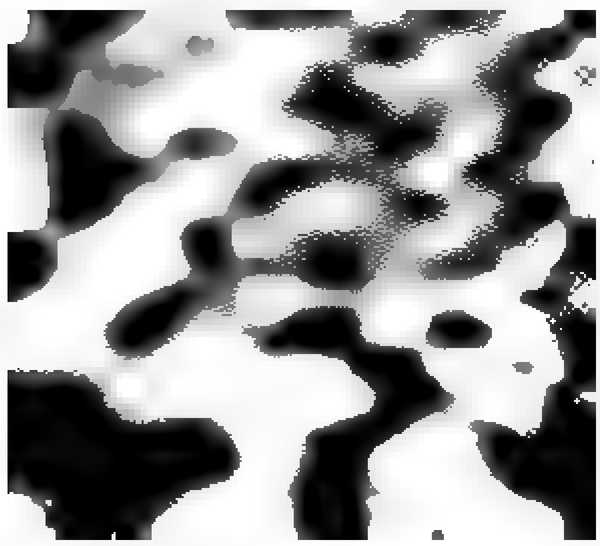
Fig 25.

Natural size.

Hammers.—There are occasionally met with, lying upon the surface of our fields, slender oval stones, with a groove entirely around them, which would be good axes had they any cutting surface. Such is not the case, however, and their use as hammers is unquestionable. Such specimens are well represented by the one given in Fig. 28. This hammer is seven

inches long and about three wide. Others occur somewhat larger. but there is no other important variation. Occasionally, an unusually shaped stone will be found to have been utilized as a hammer, having required but little alteration to convert it into the required shape. Such an one is that given in (Fig. 30), ten and one-half inches in length, with a handle about one-third of its total length; it has had a sort of edge, never less than one-quarter of an inch in width, chipped upon it. The handle has been somewhat ground down, but not polished in any degree. Securely fastened to a handle, this hammer, well directed, would give an opponent a fearful blow, but we imagine they were not used as weapons, but as hammers only; and this belief is the more strengthened by the equally abundant presence of partially polished, oval cobble stones, which we believe can be best designated, considering all things, as

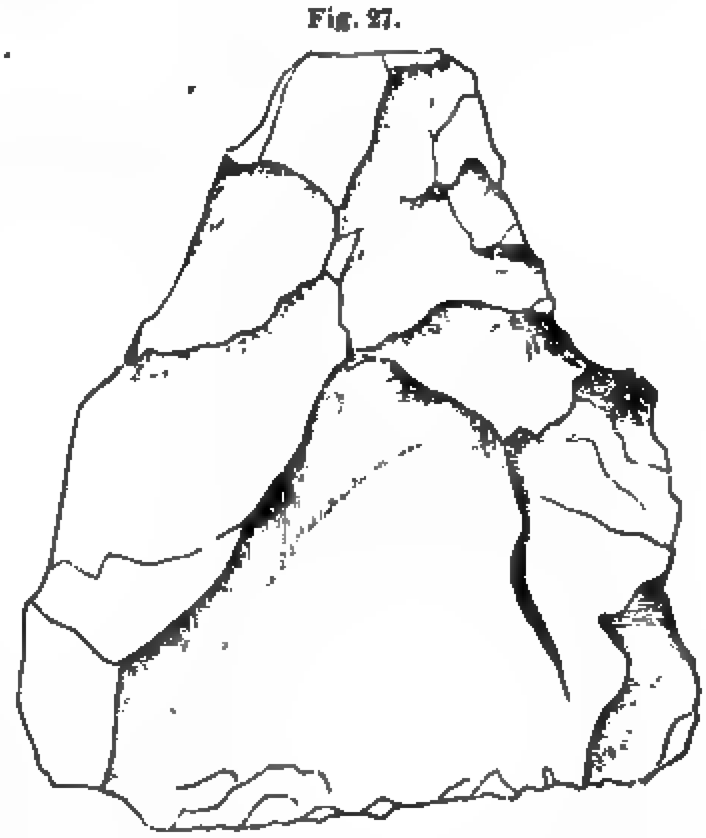
Fig 26.



Natural size.

CHISELS. — Such a chisel is that illustrated here (Fig. 29). This specimen consists of a stone that has had a beautiful cutting edge ground at one end, and *two-thirds of one surface has been split smoothly off*, making it, not a hollow gouge, but a smooth chisel. The under surface is oval, rocking to and fro if agitated while lying on that side. A sufficient number of such specimens

Fig. 27.

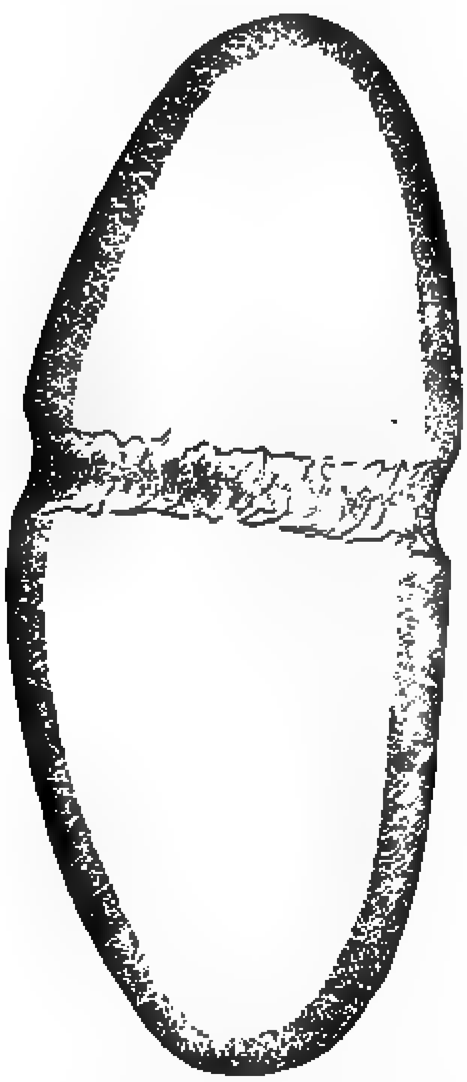


Natural size.

have been found to consider them as we have done above, rather than as adzes, hatchets or ungrooved axes.

The specimens that we have described so far have been all ordinary surface-found specimens—with one exception—and we cannot see that their use was less apparent for that fact, although a damper is thrown on one's ardor in collecting them, when Sir John Lubbock assures us that "those found singly in this manner have

Fig 28.



1-2 natural size.

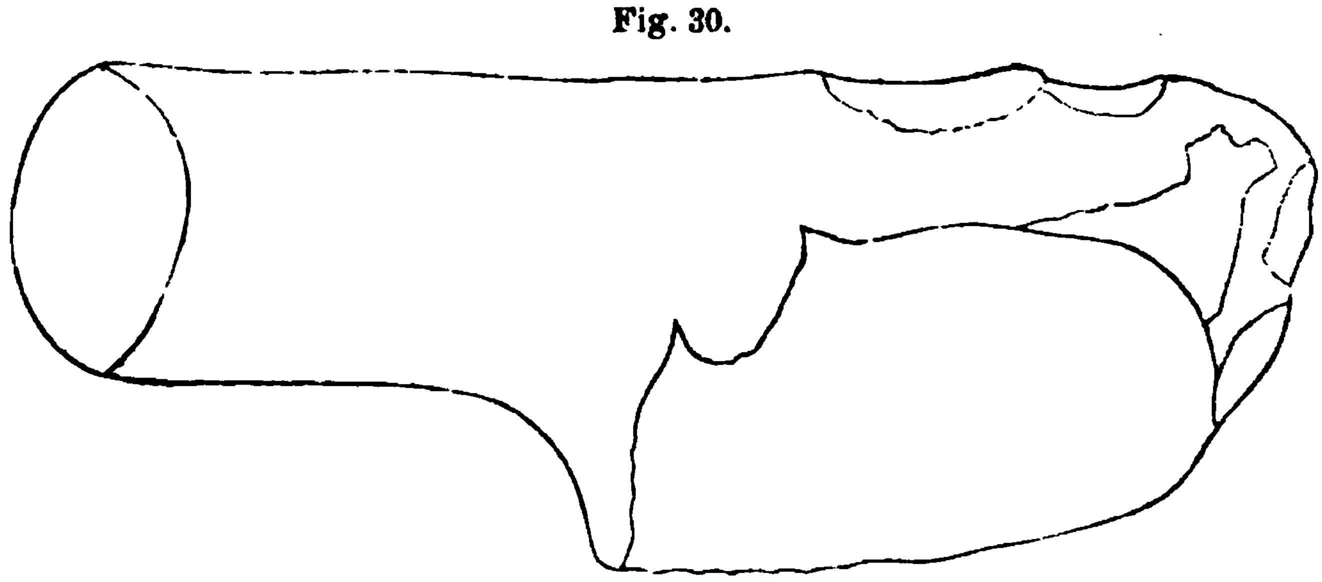
Fig. 29.

1-2 natural size.

comparatively little scientific value;" but we have not alone met with specimens thus singly found, but have met with several instances where quite large deposits of "axes" have been encountered in digging cellars and similar excavations. For what purpose this was done, nothing about "the find" gave any clue. It was only probable that for the sake of concealment from enemies or other purpose, a considerable excavation had been made and these axes therein deposited. In one case, in digging a cellar in Trenton, N. J., one-hundred and twenty were found. Again, in excavating the

"receiving vault" of the Riverview Cemetery, near Trenton, "a bushel basket full of axes were found, packed close together and six feet under ground." On the face of the bluff fronting the Delaware River below Trenton, several instances have come under the notice of the author. In the first two instances, the specimens were *all* grooved cobblestone axes. In one instance, below Trenton, the axes, over fifty, were all of porphyry, and were such as that figured above (Fig. 16). It is not a little strange that in these "finds" of axes, we have as yet invariably failed to meet with any other

Fig. 30.



1-3 natural size.

class of tools or weapons. One word as to "inscribed axes," such as that figured in "Dr. Wilson's Prehistoric Man" (2d ed. page 412, Fig. 49). When we remember that axes such as these have been for nearly two centuries (150 years at least) exposed twice yearly to the scratching of a plow, it is not strange that they should ultimately become considerably "inscribed;" and we can find a happy combination of Phœnician, Arabic, Hebraic and other letters scratched here and there over the surface of many specimens, although not with the astonishing regularity of that given in the figure above quoted of the axes from Pemberton, Burlington Co., New Jersey.— *To be continued in next number.*

REVIEWS AND BOOK NOTICES.

A New Catalogue of Butterflies.*— More than twenty years ago Messrs Doubleday and Hewitson, in their classic work "The genera of diurnal Lepidoptera," commenced a synonymic list of

* A Synonymic Catalogue of Diurnal Lepidoptera, by W. F. Kirby, 8vo, London, 1871, pp. viii, 690.

the species of butterflies, then known attempting to refer them to the genera usually recognized, or to those established by themselves. Since that time, the number of described forms has enormously increased, while the labor of specialists has multiplied the recognized genera at a nearly corresponding rate. Such being the state of the case, a faithful attempt to reduce the chaos to more or less complete order must be welcomed by every working lepidopterist; the task is in many respects a thankless one, inasmuch as by its very nature it must soon become antiquated and no amount of supplements can prevent the absolute necessity of an entirely new catalogue in the course of one or two decades. Let us then present to Mr. Kirby the thanks of the present generation of American entomologists on the accomplishment of his undertaking.

The classification of the larger groups in the work under review is mainly that proposed not long since by Mr. Bates—one which is undoubtedly an advance upon its predecessors, but which still seems open to criticism—Mr. Kirby, however, has altered some of the names accepted by Mr. Bates, supplanting, for instance, *Erycinidæ* by *Lemoniidæ* because the *generic* name *Erycina* proves to be preoccupied. The justice of this does not seem to us manifest; and in any case they are both antedated by the name *Vestales* given to this group by Herbst as early as 1793, but which has never since been recognized.

The treatment of the genera is independent, but rather unequal, depending apparently either on the compiler's autoptical familiarity with the included species, or upon the amount of study given by naturalists generally to certain groups. He has not hesitated to make some very radical changes in nomenclature, and these appear to us almost invariably just and in strict obedience to the principles exposed in the preface; indeed it seems questionable whether he has always been sufficiently sweeping in this respect; for example: the genus *Papilio* founded by Linné for all butterflies was restricted first by Fabricius to the families *Nymphalidæ* and *Papilionidæ* of the present catalogue, and next by Schrank to the *Nymphalidæ* alone; and yet Mr. Kirby retains it in the modern sense, which has indeed the unanimous consent of entomologists, but which cannot be defended by just rules of nomenclature. This seems the more indefensible in Mr. Kirby in that he has himself pointed out this error in previous writings. No doubt

such a step would have subjected him to harsh criticism, but no doubt too it would eventually have gained acceptance and saved the generation to come from a confusion and war of words from which we still trust they may be exempt.

As the author states in his preface, there are not wanting the usual accompaniments of such a catalogue—"magazine" genera; but he has specified these and they are fortunately few in number. The species of each genus are numbered and classed according to the author's views of their affinities, certainly an undertaking very difficult of accomplishment, which only the fortunate ability of the compiler to consult the large English collections cou'd render feasible; those which are unclassed are placed separately at the end of each group; more intimate relationships are designated by repeated numbers followed by a letter, only the first descriptions and those of iconographs are cited, excepting where a species has been described under more than one name, and the dates are invariably added; it is, however, to be regretted that the specific nomenclature commences only from the twelfth edition of the Systema Naturæ.* Regional distribution is marked in a distinct column for more ready reference.

In the appendix, corrections are made, the work is brought down to March 1871, and the author has taken the opportunity to alter some generic names. The index is very full and correct. Having already had occasion to use it some thousands of times, we have chanced to discover but one omission and no misprint whatever. The synonymic words are printed in the same type as the others but the genera are distinguished by capitals; the prime merit of the index consists in its condensation, it being printed in small type and in quadruple columns, so that each letter of the alphabet hardly averages over a page of names. As the work is one wholly of reference it will be seen how valuable is such a feature.

With regard to our own species, the author states in his preface that he has been in correspondence with American writers upon the subject, so that the catalogue is quite complete. We could point out a few errors into which he has fallen and mistakes which he has failed to correct, but since our own knowledge of the synonymy of the species and their proper generic location is by no means perfect, and even a matter of dispute among ourselves, such

* In his more recent writings, Mr. Kirby goes back to the tenth edition.

an attempt here would be a work of supererogation. It should however be stated that the author very often follows the lead of those who announce — apparently without sufficiently careful comparisons—the identity of many European and American forms; we are convinced that such instances will be hereafter shown to be exceedingly limited in number.

The work is one of great importance, and an indispensable hand-book for any entomologist engaged in the study of Butterflies. It is printed in a compact form, modelled upon a good plan and published at a reasonable price; we trust that it may compensate the compiler for the labor, vexation, and patient study which such a task required.—S. H. S.

Topographical Atlas of Massachusetts.—There has been recently published a topographical atlas of the state, which is of such a çharacter as to demand special consideration. It was compiled by Messrs. Walling & Gray, and seems calculated to meet an existing and long-felt want.

It opens with a general view of the topography of Massachusetts, which is followed by a succinct summary of its history by Albert H. Hoyt. This summary contains a statement of some of the more important events characteristic of the period of settlement, of the colonial period, and that of the commonwealth proper, with lists of the most prominent public officers.

A rather complete history of the railways of Massachusetts is given by Edward Appleton, Railway Commissioner, while there appears in another part of the work an abstract of School Returns, including the population of each town and county, from the United States Census of 1870, followed by a list of the cities, towns, villages, post offices, railway and telegraph stations.

A rapid sketch of the geology of Massachusetts, with a revised geological map, has been furnished by Charles H. Hitchcock, Professor of Geology in Dartmouth College. This account is, in part, an epitome of the results reached by the late President Hitchcock, there being many modifications suggested to the son by more recent studies. While the classification of the rocks is by no means satisfactory to the writer, the identification of many of the beds being very questionable, and while the recognition of the Eozoon as organic is certainly premature, it should still be remembered that the geology of Massachusetts is in no wise as yet

thoroughly worked out, and that this sketch with the accompanying map will be likely to prove of great service to thousands, who may by these means gain some knowledge of the structure of this portion of the earth's surface.

A brief and accurate account of the principal vegetable forms found in the state, also a like account of its more prominent animals, might be introduced into this part of the volume, in subsequent editions, with no small advantage to the young and to all those who have not access to more purely scientific works.

The volume also contains a short sketch of the climate of Massachusetts, with a climatological map, by Lorin Blodget, author of "Climatology of the United States." This is an interesting feature of the work and is calculated to attract attention, especially in view of the marked prominence which the subject has recently assumed.

Finally, there follows a series of maps to which the several portions of the work already mentioned really serve, and properly, as an introduction. Of these maps, three are general, one being of the United States and Territories, another of New England, while the third is a railway and township map of Massachusetts. There come next maps of the several counties of the state, on a scale of two and a half miles to an inch; and last of all, maps of Boston and vicinity, and of the other principal cities in the Commonwealth.

In the construction of these maps no small expense has been incurred, and much care exercised. The compilers have availed themselves of the results of the astronomical, trigonometrical and various local surveys, and have spared no pains in their efforts to render their work deserving of confidence. While absolute correctness has not been reached and is not claimed, a fair degree of accuracy has been very generally secured. Though the maps be by no means equal to many of those recently published in Europe under government patronage, they are yet, for the ordinary purposes for which they are likely to be consulted, calculated to be almost equally useful; and while the government maps referred to are very expensive, these cost the buyer scarcely a tithe in proportion, and will be of immense practical value in rendering a better knowledge of the topography and physical features of the state possible to citizens at large.

The publication of this atlas being thus an important step in

the right direction, it is to be hoped that it will prove widely useful, in awakening and developing an intelligent interest in the geography and natural history of the state.—J. B. P.

TWO LATE AMERICAN PAPERS ON ORNITHOLOGY.*—Mr. Ogden's article is an acceptable contribution, but like most early essays would have been the better for competent supervision. Rüppel is not the author of the Planches Enluminées, nor can we accept, even on Linnæan authority, St. Domingo as the habitat of an Asiatic bird. When geographical names are totally inept, ornithologists cancel them; *C. Dominica* (L.) should stand as *C. Brissoni* Wag., and *C. Ludoviciana* (Gm.) as *C. miles* Bodd., the latter having, moreover, priority. Without criticising the specific determinations, several of which appear to require modification, we must indicate an oversight respecting the four species Mr. Ogden has not seen. Arranging the eleven of the Academy's collection in three groups, according to the development of the wattles and carpal spines, the writer continues directly with numbers 12-15, which brings them under "*c*, species devoid of wattles" etc., which is not the case with all of them. Thus, *C. miles* is a wattled and spined species, very near if not identical with *C. personatus* Gould, which Mr. Ogden correctly locates under *a*. Some other species here admitted are probably invalid, as *C. Uralensis* Evers., which is generally assigned to *leucurus*. The term "*Lobivanellus*" is not exactly synonymous with *Chettusia*, as would seem from the title of the paper, these names being merely two of several that have been proposed for different groups of these birds. The new species is *C. nivifrons*, from "Fazoglou," belonging, as we judge from the plate, to the unwattled group.

Mr. Lawrence describes *Catherpes Sumichrasti*, apparently a second species of the genus, although, as the tail is wanting, he is not satisfied of its position. It is, he says, "rather a remarkable looking bird," with the bill shaped precisely as in *C. Mexicanus*; of stouter form and darker colors, with small white abdominal spots like the dorsal ones of that species. The type is in the Smithsonian Institution, from Vera Cruz. Three new fly-catchers are *Myiozetetes*

*Synopsis of the genus *Chettusia* (*Lobivanellus*), with a description of a New Species. By J. A. Ogden. Pr. A. N. S. Phil., Oct. 1871, 194; pl. 1. Descriptions of New Species of birds of the families Troglodytidæ and Tyrannidæ. By Geo. N. Lawrence. Ibid. Nov. 1871, p. 233.

grandis (Tumbe, Peru, type in Vassar College), *Empidonax atrirostris* (Venezuela?, type in Cab. Lawr.) and *Myiarchus Yucatanensis*. This last is highly interesting, owing to the novel identifications it implies. It is what Mr. Lawrence in 1869 (Ann. Lyc. Nat. Hist., N. Y.) called *M.* "*Mexicanus* Kaup," whilst contending, very properly, for the distinction between his *cinerascens* and Kaup's bird. To everybody's surprise, Kaup's *Mexicana*, only lately identified, proves to be what Baird called *M. Cooperi* in 1858. This announcement of Dr. Sclater's, upon examination of Kaup's type specimen, of course makes quite a commotion in the synonymy of the several species implicated.— E. C.

BOTANY.

New Parasitic Plant of the Mistletoe Family.— Miss Millington of Glens Falls, N. Y., sends some specimens of the curious new parasite which she discovered last summer in Warren and Essex Counties, N. Y. and which have very much interested our botanists. It grows upon the branches of Black Spruce trees so abundantly that it has evidently injured, and apparently killed, some of the trees most infested by it. *Arceuthobium Oxycedri* of Bieberstein grows on juniper trees in the Caucasus region, and here and there in Southern Europe as far west as Spain. This was the only species known, and the only habitat, until Sir William Hooker brought to light American plants growing on Pine trees in the Hudson's Bay region and west to Oregon and gave a good figure in his Flora-Boreali Americana, referring it to Bieberstein's species. Mr. Nuttall, however, distinguishes this American species as *O. Americanum;* and Dr. Engelmann about twenty-five years ago distinguished two more species from the far west and south west. These plants are a sort of Mistletoe, of diminutive size, with small scales at the joints in place of leaves. They were unknown nearer to us than Hudson's Bay and the Saskatchewan on the north, and the Rocky mountains on the west, until last summer, when Mr. Peck of Albany surprised us by sending, for a name, a specimen of an *Arceuthobium* in fruit, collected by himself, if we rightly understand, in Rensselaer County, New York, inhabiting a black Spruce. Miss Millington, to whom belongs the credit of first detecting the plant, sent her specimens later. She found it in two localities and

in great abundance. "The limbs of the trees affected were very much distorted: every twig bristled with the little parasite, and some trees seem to have died from the effects of its absorption of their sap." It is curious to notice, first that a plant of this sort, growing on the boughs of Spruce trees in such quantity as to distort and even destroy them, and in three (adjacent) counties of a long and fully settled region, has been entirely overlooked, and then, when discovered, found about the same time by two independent observers at considerable distance from each other. We may now expect that it will be detected through the whole length of the Adirondacks, at least if it proves to be the same species as that of Hudson's Bay, as we think is likely. It grows, however, upon Spruce instead of Pine. The plants are diminutive, and in Dr. Engelmann's opinion, which is much to be relied on, is probably specifically distinct. So he names it *Arceuthobium minutum*. Curiously enough Mr. Elihu Hall found last summer, in Oregon, a larger *Arceuthobium* also inhabiting Spruce trees, and may therefore throw more light on the study of the New York plant. The specimens are now in the hands of the botanist most competent to this investigation, Dr. Engelmann of St. Louis — A. Gray.

Floral Curiosity.— A friend has brought me a Fuchsia, grown in his parlor window, which exhibits one of those abnormal growths not uncommon in the vegetable world, but which I have not observed among Fuchsias. Two of the outer sepals are perfect green leaves, precisely similar to the ordinary foliage of the plant, tapering to a broad petiole and uniting at the base, with the two normal sepals, to form the tube above the germ. The rest of the flower does not differ from other blossoms. It is an interesting instance of the well understood fact that sepals and corollas are transformed leaves, or rather advanced development of leaves.— C. J. S.

E. Hall's Collection of Dried Plants of Oregon.— Mr. Elihu Hall of Illinois passed last summer in Oregon, where he was most industriously occupied in amassing a large collection of botanical specimens. These are now being arranged and named and will soon be offered to subscribers in sets, at eight dollars the one hundred specimens. The magnitude of the sets of Phænogamous and Vascular Cryptogamous plants may be rightly

than are to be found in the adult larvæ of allied genera. By the term "embryonic" he designates those caterpillars which have not changed their condition since leaving the egg, a stage in which they generally continue but one or two days. Some of the changes alluded to are more or less gradual in their appearance, but they generally occur at the first moulting of the caterpillar.

He incidentally remarks that in studying caterpillars "the shape and sculpturing of the head, the form of certain segments, and especially the precise number, location and disposition of the spines, thorns, and hair-emitting warts of the body will be found to furnish abundant means of distinguishing the most closely allied and minutely subdivided genera."

The differences he proceeds to describe "are not always in the same direction; for we have seen that caterpillars which in infancy are clothed with appendages of a unique and conspicuous character, definitely disposed, display in mature life irregularly distributed, scarcely perceptible warts, emitting simple and nearly microscopic hairs; while others, which in their earliest stage bore regular series of simple hairs seated on little warts, become possessed at maturity of compound spines, surmounting mammulæ, also definitely arranged, but occupying a very different position to the hairs of early life. So, too, we find some caterpillars which bear a tuberculated irregular head in infancy, and a smooth and equal one at maturity; or the reverse, when the head is simple at birth, and heavily spined or cornute when full grown; others, again, remain almost unchanged through life. This latter condition of uniformity never applies to the appendages of the body, whether we consider their characters alone, or their disposition. Nor—the only other possible condition—do we ever find larvæ bearing only irregularly distributed, simple, minute hairs in infancy, and regularly arranged special appendages at maturity. Indeed, it is doubtful whether such a phenomenon exists in nature; since in the numerous and varied groups that have been examined, special dermal appendages have been found to be an invariable characteristic of embryonic larvæ."

Propagation of Salmon.—During the past season the first attempt to obtain eggs of the sea-going *Salmo salar* within the limits of the United States was made at Orland on the Penobscot River; and as this was also the first authenticated experiment of

confining salmon for breeding purposes through the summer and fall, it deserves some mention. It was necessary to buy live salmon of the fishermen near Bucksport in the early part of the summer, because later in the season they are scattered over the head waters of the river in the wilderness. It was found that in common brook, river, or pond water of sufficient depth and flow, the salmon would remain in perfect health from June till November. A pond specially prepared for them in a very clear, cold brook proved unsuitable, and every salmon placed there died. The seventeen fish that remained at hand in the beginning of the spawning season were kept in a pound built of stakes and nets on the margin of a large pond. The area enclosed was some fifteen or twenty square rods, and the depth of water about six feet at the deepest point. Confinement within this narrow enclosure does not appear to have hindered in the least the development of the spawn and milt. Ten out of the seventeen were found to be females and nine of them yielded eggs freely. The method of fecundation differed from that commonly employed, in that the eggs and milt were carefully kept from water until they had come in contact. This method is of Russian origin. It was in this case remarkably successful. About ninety-six per cent. of the eggs were fecundated. They were taken between the 2d and 10th of November, and on Dec. 18th they were packed up, to the number of seventy thousand, five hundred, and distributed in nearly equal proportions to the three States of Maine, Massachusetts and Connecticut.

The conditions under which the seventeen salmon were kept preclude the idea that they could obtain any considerable amount of food, and there is no good reason for thinking that they ate anything at all after they were brought from the salt water in which they were caught. They slowly fell away in flesh, and at the spawning season were very gaunt, compared with their condition in June. More noteworthy was their change in color and shape. In color they were darker, with clusters of red spots on the sides, and a general reddish tinge covered the lower parts of the body in nearly all cases. These colors and markings were dull and indistinct in the females, but were very bright in most of the males. In shape the females had undergone some change about the head, but it was not remarkable. In the males, however, the alteration was very marked. The sides were flat and broad, the back arched high, the head seemed disproportionately large, the

jaws were long and curved. At the extremity of the lower jaw was a large, curved process that shut into a cavity in the roof of the mouth. There was, indeed, between the two sexes as great a difference as there is between the male and female of our common domestic fowls. Yet in June there was so little difference that only a practised eye could distinguish the male from the female salmon. The fishermen who had been handling them all their lives had never observed the difference.

During the process of spawning and after its completion both sexes continue to fall away in flesh and soon the colors begin to fade. At the end of a month the process on the lower jaw is found to have decreased in size. Two females and one male taken from the water on the 23d of November, thirteen days after the completion of the spawning, were forwarded to the Peabody Academy of Science. To the same institution was sent another specimen, a male, that was put, early in July, into a pond of one or two hundred acres in Bucksport, and running into a brook in November, was taken thence after ten days. This was the finest specimen seen, a strong, stout-built fish thirty-four inches long and weighing eleven and a half pounds. His colors were unusually deep, perhaps in consequence of the deep reddish color of the water, through which nothing could be seen at the depth of three feet.—C. G. A.

An Ornithological Blunder.—Having submitted the case of "Bonasa Jobsii" (*Jaycox;* "Cornell Era," IV, 182) to an ornithologist, requesting him to pass upon it, we are favored with the following reply:—"Newspaper science is rarely worth serious attention, but as the 'Era,' a publication of an institution of learning, notices a supposed new species of bird which, it appears, is named by the President of the University, although described by another gentleman, I suppose the article must be recognized, to the extent at least of blaming it for introducing a new synonym of the ruffed grouse. It is such a complete fiasco, and at the same time is written with such ingenuousness, that I cannot do what you ask and spare the writer's feelings too. I must say that not one of the 'striking differences' that Mr. Jaycox thinks 'are sufficient to characterize a new species and perhaps a new genus,' are of the slightest consequence. *Bonasa umbellus* usually has eighteen tail feathers, but is also found with sixteen, as well as

twenty, as in this instance. The alleged difference in proportions of tarsus and middle toe is within the ordinary range of individual variation; while the points of color adduced may be matched in almost any game bag — indeed, I do not see how the writer ever discovered them, intent as he says he was on the edible qualities of the bird, to which he had better have confined his investigations. He is not to blame, of course, for knowing nothing of ornithology, but he ought not to have rushed into print on the subject, when any ornithologist would willingly have examined his specimen for him, and kept him out of a scrape. If you think this bears down too hard on the writer, ease it up a little; but I really think that Mr. Jaycox will in the course of time thank you for printing it; I remember that just such raps did some of my early lucubrations good."

ALBINISM AND MELANISM. — In the November number of the NATURALIST is an article on a "Singular Albino," an "albino bobolink" (*Dolichonyx oryzivorus*) "illustrating a rare and curious condition," being "of a uniform pale yellow, exactly like a canary bird."

I would like to ask the writer or any of the readers of the NATURALIST if they have ever seen an albino bobolink marked otherwise. I have one taken in this vicinity which perfectly answers to the description given above. It looks precisely like a yellow canary with the exception of size and pointed tail feathers. The remark is frequently made by those visiting my collection, "what a large canary that is." This is the only albino bobolink that I have seen, and it may be unusually marked, yet the description in the NATURALIST so exactly corresponds to the one in my cabinet, that the thought occurs to me that this perhaps may be the usual color of the albino of this species. Although albino signifies white, yet there may be various shades of white. I find this statement verified in my own collection. Before me is an albino mink (*Putorius bison*), muskrat (*Fiber Zibethicus*), two wharf rats (*Mus decumanus*), two house mice (*Mus musculus*), pure white, and also an albino red squirrel (*Sciurus Hudsonius*), meadow mouse (*Arvicola riparius*), blue-bird (*Sialia sialis*), two robins (*Turdus migratorius*), barn swallow (*Hirundo horreorum*), cliff swallow (*Hirundo lunifrons*), white, but not pure white. They are more of a dingy white. In the bobolink described above, it might be called yellowish white. In the albino the eye is always red.

Albinism is much more common than melanism—the latter is seldom found. In my collection of about two thousand specimens of birds and animals (one thousand mounted) there is but one specimen of melanism, a black woodchuck (*Arctomys monax*).—WM. WOOD, M.D., *East Windsor Hill*, *Conn.*

DREDGINGS IN THE GULF OF ST. LAWRENCE.—Mr. J. F. Whiteaves has during the past summer, according to "Nature," dredged in from fifty to two hundred and fifty fathoms in the Gulf of St. Lawrence. At a depth of one hundred and sixty and two hundred fathoms a number of sea pens (*Pennatulæ*) were dredged, this genus not having previously been found on the Atlantic coast of America. A Spatangus also occurred; and the following shells, which are new or very rare on this side of the Atlantic:—*Pecten Grönlandicus* Chemn. not Sowb., *Arca pectunculoides* Sacchi, *Yoldia lucida* Lovèn, *Y. frigida* Torell, *Neæra arctica* Sars, *N. obesa* Lovèn, *Dentalium abyssorum* Sars, *Siphonodentalium vitreum* Sars, *Eulima stenostoma* Jeffreys, *Bela Trevelyana*, *Chrysodomus* (Sipho) *Sarsii*, and *C. Spitzbergensis*, the latter shell occurring in shoal water.

THE ORIGIN OF INSECTS.—At a meeting of the Linnæan Society of London held on November 2d, Sir John Lubbock, Bart., F.R.S., read a paper on this subject, which has always presented one of the most difficult problems to the Darwinian theory. There is great difficulty in conceiving by what process of natural selection an insect with a suctorial mouth like a gnat or a butterfly could be developed from a powerful mandibulate type like the Orthoptera, or even the Neuroptera. M. Brauer has recently suggested that the interesting genus Campodea is, of all known existing forms, that which most nearly resembles the parent insect stock, from which are descended, not only the most closely allied Collembola and Thysanura, but all the other great orders of insects. In these insects we have a type of animal closely resembling certain larvæ, which occurs in both the mandibulate and suctorial series of insects, and which possesses a mouth neither distinctly mandibulate nor distinctly suctorial, but constituted as a peculiar type, capable of modification in either direction by gradual changes, without loss of utility. The complete metamorphosis of the Lepidoptera, Coleoptera and Diptera, will then be the result of adaptive changes brought about through a long series of generations.—A. W. B.

Change in the Habits of a Bird.—The New Zealand papers state that in certain districts in those islands the sheep are being constantly attacked by the Kea or "mountain parrot" (*Nestor notabilis*), belonging to the family of Trichoglossina or Brush-tongued parrots, which infests the neighborhood. These birds are seen sticking to a sheep and pecking at it producing a patch of raw flesh on the loin about the size of a man's hand, from which matter continually runs down the side, taking the wool completely off that part which it touches, and in many cases causing death. The fact is of interest, as affording an instance of entire change of habit within a comparatively recent period. The Kea, like other birds of the family to which it belongs, was originally a fruit-eater, or occasionally feeding on insects concealed in the crevices of bark and rocks. It is only since the colonization of New Zealand by Europeans that sheep or other large mammals have been introduced. The parrots are also frequently seen tearing at the skins of sheep which have been hung up to dry, and they were probably first tempted by these when their natural food ran short in the winter.—A. W. B.

Reproduction of Sturgeon.—The following observations on the sturgeon of the Volga by Professor Owsjannikow and others are recorded in the "Bulletin of the Acclimatization Society" of Paris. The sterlet (*Acipenser ruthenus*), the smallest of the Russian sturgeons, spawns in the Volga early in May on rocky bottoms, the temperature of the water being at 10° R. (= $54\frac{1}{2}$° F.). The eggs are readily fecundated by the artificial method. After they have been in the water a few minutes they adhere to any object which they touch. The development of the embryo can be observed in progress at the end of one hour. On the seventh day they hatch. At first the young fish are $0^{m}.007$ (about $\frac{27}{100}$ inch) long. At the age of ten weeks they are nearly two inches long. They feed on larvæ of insects, taking them from the bottom. Both in the egg and when newly hatched, the sterlet has been taken a five days' journey from the Volga to Western Russia, and in 1870 a lot of the eggs were carried to England to stock the river Leith. This species passes its whole life in fresh water. The other species inhabiting the Baltic, *Acipenser sturio*, *A. Huso*, *A. stellatus* and *A. Güldenstädtii*, are anadromous. These species hybridize, and freely, and from this circumstance some Russian savants have pronounced them only varieties instead of species.—C. G. A.

Partial Development of Eggs without Fertilization.—Hensen has observed that the eggs of rabbits, unimpregnated and within closed cysts, developed themselves into polynucleated protoplasmatic masses and fibres. Kupffer also noticed that in Ascidia there arises in the egg before impregnation a peripheral layer of cells which, later on, after impregnation, becomes the external covering of the animal. More recently, as we learn from the "Quarterly Journal of Microscopy", Œllacher has observed the remarkable fact that even in warm blooded vertebrata the first act of embryonic development, namely, segmentation, may take place independently of impregnation.

Flora and Fauna of the Azores.—The most striking fact brought out by Godman's "Natural History of the Azores, or Western Islands," is the wonderful amount of similarity between the productions of these remote islands and those of Europe; from eighty to ninety per cent. of the birds, butterflies, beetles and plants being absolutely identical with common European species, while from one to four per cent. only are American. This is the more remarkable when we turn to physical maps for information and find that both the oceanic and aërial currents are from the westward, so that we should naturally expect the American element of the fauna and flora to be much better represented. The difficulty, however, is to a great extent cleared up by Mr. Godman's observation that the Azores lie in a region of storms from all points of the compass; and that every year these storms bring numbers of birds from Europe, and no doubt also numbers of insects, although these are not so easily observed. We can thus account for the enormous preponderance of European species; and this, taken in conjunction with the entire absence of indigenous Mammalia and Reptiles, causes our author to reject the theory of a common continental extension uniting these islands to Europe as the origin of their fauna and flora. Had this been so, and taking into consideration the vast time implied by the descent of a thousand miles of country to the depth of fifteen thousand feet, we should certainly have found the productions of the Azores to be far more endemic and peculiar than those of Madeira and the Canaries, instead of far less so.

The most curious and difficult problem is presented by the existence of a considerable number of wingless beetles of genera peculiar to the Atlantic islands (Azores, Madeira, Canaries). These

could not possibly, in their present condition, have been transported over the six hundred miles of ocean that now intervene between these groups. Mr. Wollaston has, however, discovered that beetles have a tendency to become apterous in these islands; many which are winged in Europe, or belong to winged genera, being altogether wingless in Madeira and the Canaries. Some of these wingless species differ in no other respect from their European allies, so that we may be súre the change has been effected in a comparatively limited time; and the fact that some European species possess both winged and wingless individuals shows that the character is an unstable one, and therefore easily abolished or retained as one or the other state becomes advantageous to the species. We are thus at liberty to suppose that these wingless Atlantic groups are the descendants of very remote winged ancestors, who were among the earliest immigrants to all these islands; and these being subjected to similar conditions, all became apterous. Another strange phenomenon is presented by the *Elastrus dolosus*, a beetle of the family Elateridæ which belongs to a genus peculiar to Madagascar. A single plant, *Myrsine Africana*. a native of tropical Africa and the Cape of Good Hope, is found in no other group but the Azores where it seems to be common. As another beetle of the same family (Elateridæ) is allied to a Brazilian species and is therefore probably the descendant of an ancestor who came over in a floating log, we are led to speculate on the possibility of this anomalous Madagascar beetle and S. African plant having been introduced by a similar process; since the currents round the southern extremity of Africa partially merge into the great equatorial current of the Atlantic which gives rise to the Gulf Stream, and this undoubtedly reaches the Azores.

Mr. Godman had previously visited the Galapagos Islands, which are only half as far from South America as the Azores are from Europe, yet they contain hardly any identical species of birds, plants or insects. This is well explained by the fact that these islands are situated in a region of calms instead of one of storms; and chance introductions being therefore a far rarer occurrence, the early immigrants have all become modified, and have so stocked the country with their peculiar and well adapted forms that new comers (if any do come) have little chance of establishing themselves.—ALFRED R. WALLACE, *in the Academy*.

Circulation in Insects.— Mr. H. N. Moseley finds the circulation of insects to be observed most advantageously in the wings of *Blatta orientalis*. The details and results of his methods of observation are given in the "Quarterly Journal of Microscopical Science." When *B. orientalis* casts its skin it emerges quite soft and milk-white: at which time light may be thrown through the body, and the action of the heart and valves studied to advantage. The circulatory system of insects is injected with difficulty from the heart: a more certain result is obtained by cutting off half of one wing and injecting, through the cut edges, either the removed portion of the wing, or the remaining portion and through it the heart. Indigo-carmine, or Berlin blue solution, is preferred as the injecting fluid. Mr. Moseley places the fluid in a short india-rubber tube closed at one end and furnished with a canula at the other, and forces it into the insect's veins by pressure of the finger upon the tube; a procedure which would seem to be applicable to many other cases.—R. H. W.

GEOLOGY.

The Chantauqua Mastodon.—The remains of a skeleton, belonging to the extinct species of animal, *Mastodon giganteus*, were discovered the twenty-fifth of August, 1871, in the vicinity of Jamestown, N. Y. These remains were found imbedded four feet below the surface, in soil composed of peat and marl, and deposited in the Post-tertiary period; and were located in a swamp, two acres in extent, situated upon a farm now owned by J. E. Hoyt, formerly known as the Reynolds place, about one mile north of the village of Jamestown. This small swamp, fed by springs, had been drained five years ago, and last August workmen were excavating the muck, scattering it upon a four-acre field, when they finally came to the tusks estimated to be *twelve* feet in length before they were much disturbed or broken. They found also, in proximity to the visceral cavity of the larger skeleton, a mass of undigested food, some eight or nine bushels in quantity, and consisting of slightly decayed twigs, of two or three inches in length, identified as cone-bearing species, similar to our pines and firs, and remarkably preserved.

At the time of my visit, upon the 16th of September, the remains were deposited mainly in the cabinet of the "Union School

and College Institute." I also found a portion of the bones, particularly those of the smaller animal, at the residence of Prof. S. G. Love, to whom I am much indebted for information bearing upon the subject.

The left side of the lower jaw, preserved almost entire, was two feet in length; and the size of cranium, from sections observed, was some three and a half feet in length. The depth of the jaw bone was seven and a half inches; its width six inches. There were two fragments of one tusk; the point, three feet and seven inches in length, six inches in width, with marked depressions upon one side of surface; the other fragment, two feet five inches in length, seven and a half inches in diameter and much decayed; an intermediate section and the one adjoining the cranium were gone. There were six teeth; larger ones seven and a half inches in length, weight five and a half pounds, with mammillated eminences (distinguishing the species), of about two inches in elevation. The enamel was well preserved. Sections of scapular were thirteen inches long, seven inches wide; fragments of ribs, twelve to eighteen inches in length. A section of the ribs, as first found, was five feet in length. Head of femur bone was also here.— I should judge the height of the larger skeleton to be fifteen feet, its length seventeen or eighteen feet.

The smaller skeleton (found at a short distance from the larger one), was probably seven feet in height; tusks four feet long, four inches wide; teeth three and half inches in length; sections of jaw and rib bones were also found.—T. A. Cheney, *Leon*, *N. Y.*, *Nov.* 13, 1871.

A New Fossil Butterfly.— Mr. S. H. Scudder has discovered a new species (and genus) of butterfly from Aix which is contained in the museum at Marseilles. He calls it *Satyrites Reynesii*, after the direction of the museum. The specimen consists mainly of the two forewings, the venation of which can be made out very satisfactorily. It is of the form, and has the general appearance, of Portlandia, though nearest to the East Indian Debis.

ANTHROPOLOGY.

Flathead Indians.—I will give you now a short outline of the religious traditions of the Flatheads, comprising also their notions about the globe, etc.

The earth, according to them, is not spheroidal but flat, and surrounded with water on all sides, like an island, and heaven or sky is nothing else than a huge hollow mountain, covering the earth, as the covering of a kettle. Before the creation, *Skòmelten* (obsolete word, meaning mother, and which was substituted by the word *Skói*), a woman very powerful, and who took existence by herself, begot a son without assistance of man, and this son undertook to create heaven, and earth, and man; and for his dwelling he chose the summit of the covering, namely, heaven, whence he took the name of *Amòtkan*, which means, *He who sits on the tops of the mountains;* while Skòmelten, his mother, remained above on another land beyond the waters; for besides our earth, they thought that *Amòtkan* created other worlds, under, above and around us.

This *Amòtkan* was then considered as their invisible God, who has also many sons, though no wife; and when the Indians saw the whites for the first time, they considered them to be the natural sons of *Amòtkan*, and consequently immortal, until they saw one of them killed by the Blackfeet.

The first generation of mankind became very wicked, and turned a deaf ear to the admonitions of *Amòtkan*, who, in his wrath, drowned them all in a general inundation. *Amòtkan* undertook a second creation of a race of people, twice as tall as the first ones; but proving worse than the first, they were all destroyed by fire which came from heaven. The third generation being as bad as the first and second, was destroyed by *Amòtkan* through a general pestilence. The fourth generation would all have been annihilated on account of their crimes, had not mother *Skòmelten* interceded with her son in behalf of mankind. The wrath of *Amòtkan* was appeased by the prayers of his mother, and he promised never to destroy his creations again. But until that time the world was in perfect darkness, there being no sun; and the people being persuaded that the darkness was the cause of their wickedness, they held a general council for the purpose of enlightening the world; but as every one refused, *Sinchlèp* (a small prairie-wolf), being the smartest of all the animals, undertook and succeeded in lighting the world very little less than the actual sun, and the people were very glad. But the animals of those times had the power of speaking, no less than the people, and *Sinchlèp*, being very cunning, interfered too much in their secret business, and in pass-

ing by during the day published the actions which the people performed in secret; wherefore, in anger, the people took *Sinchlèp* by the tail, which at that time was very long, and fastening him to the ground, prevented his being seen any more. The crow then offered himself in place of *Sinchlèp*, but, being naturally so very black, gave little light, and, unable to endure the ridicule of the people, he retired with shame.

Finally *Amòtkan* sent one of his sons, called *Spakaní*, to enlighten the world. Before doing so, *Spakaní* wished to marry with a woman of the earth. In coming down from heaven, he landed first in the camp of the Flatheads; but the people seeing him, though very handsome, but so different from themselves, refused him admittance to their lodges. *Spakaní*, very much displeased, left the place, and seeing near the village a small cottage, inhabited by a family of frogs, he went in, complained of the people, and showed his desire to marry one of the frogs. There was one, very large and fat, and thought herself very happy to become the wife of the son of *Amòtkan*, and with one jump she became one flesh or incarnated with the cheek of *Spakaní*, and thus matrimony was celebrated or consummated. The people, on seeing the cheek of *Spakaní* so disfigured, and enraged at the presumption of Mistress Frog, tried with sticks to kill her, until the frog, very much ashamed, prayed her husband to leave the earth; and since he had come to make himself sun, to go up immediately, which he did; but to revenge himself for the contempt of the people, he does not allow them to see him clearly during the day, when he covers himself with a shining robe, and at the approach of night, he deposits his robe, crosses the waters under the earth, and then only shows himself as he is, with his wife frog on his cheek.

For these Indians, the sun and moon are one and the same thing; and this notion accounts for the reason why they have but one and the same word to express both sun and moon, namely, *spakaní*; and so also the spots in the moon are nothing else than a frog.

Having heard this story, I asked them (there were several chiefs among those present) whether they really believed the fable; and they answered that they did, not knowing better; then I asked them what they thought when they saw the sun and moon at the same time during the day. They all started, looked at one another in surprise, looked up, as though searching the sun and moon, then

joined in a general laugh, and covered their faces as if ashamed; and one of them, looking at me with only one eye across his fingers, said, "Well, we were all beasts, and like enough not one of us has ever observed and remarked what you say now." Since that time it was agreed to call the moon by the name of *spakaní skukuèz*, meaning the *sun of the night*.

As to the immortality of the soul, the end of the world, the recompense or punishment after death, they have the tradition that man in dying, dies only half—that is, the body; the other half (which they anciently did not know how to designate, but which afterward their ancestors called *Singapèns*) does not die, but the singapèns of the good ones go to stay with Amòtkan; though without knowing to what particular bliss, and the *Singapèns* of the wicked go to another place, not determined, having no other punishment than to be deprived of the company of *Amòtkan*. For wicked they intend liars and thieves, as they consider lying and theft, if not the exclusive, at least the greatest sins. Moreover, they said that the earth and the people have one day to come to an end, and that after this last day all the dead shall come to light again, and shall be placed in another land, better than the present, and that after such epoch the people shall die no more.

Notwithstanding the power and nobility of Amòtkan and Skòmelten, these were not the deities which the Flatheads worshipped, but Spakaní, the sun. After him came as geniuses the animals of every kind, the beaver, the crow, the deer, etc. But *Sinchlèp*, the prairie-wolf, was regarded the most powerful and favorable to mankind. To show the power and favor of *Sinchlèp*, their ancestors reported that there was a time when a large portion of the earth was inhabited by a set of giants, terrible men, who killed every one they met with, for which they were called *Nàtliskèliguten*, which in ancient language means "killers of men;" that *Sinchlèp*, in pity for the smaller people, went through all the earth, killed every giant, and converted them all into large stones; and even of late, when the Flatheads in crossing the mountains saw a basaltic stone standing upright, they said to one another, "*Keep aside, there is a Nàtliskèliguten killed by Sinchlèp;*" and every large piece of silex they saw, was for them a fragment of an arrow of the "killers of men." As it oftentimes happens that one or more of these prairie-wolves come at night to howl near the village, there are still many, particularly the old women, who believe

that *Sinchlep's* howling foretells the arrival by the next day of somebody, either friend or foe, provided he only howls three times.

The worship which our Indians rendered to the sun, consisted in raising up towards the sun a morsel of meat or roots before eating them, and saying, "Sun, have pity of us, that animals and fruits may grow abundantly." In their particular distresses each one prayed to whatever first met his eyes, whether a tree or a stone.

In worshipping the sun, our Indians were not as fervent as the Blackfeet are even now; who, not satisfied with offering a parcel of their food, very often cut off large pieces of flesh from their bodies and offer them to their *Natósa* (the sun), particularly when they go to war. I asked an old man, well nigh a hundred years of age, if he prayed when he was young, and how he prayed. "Oh! yes," he answered, "every morning my mother took me into the woods, and having found a dry pine-tree, broken and rotten from old-age, she told me, 'My son, go and rub yourself against that tree, and pray.' And so I did, saying, 'O my good tree! have pity of me, and let me live as long as you have lived;' and I repeated always the same prayer; my mother did the same at another tree not far from mine, until our sore shoulders compelled us to put an end to our prayers."

Generally the prayers of our Indians consisted in asking to live a long time, to kill plenty of animals and enemies, and to steal the greatest number of horses possible; and this was the only instance when to steal was not a fault, but a great merit and bravery, since no man could ever hope to become a chief unless he had killed at least seven Blackfeet, and stolen twelve horses.

As it happens rather often that both people and animals are killed by lightning, so they regarded it as an evil genius; and the rainbow was for them nothing else than the same lightning looking down for prey amongst the people; they believed that the only means to avoid being killed, was to move off immediately and to go and encamp at some miles' distance.

NOTE.—The above is from a letter of Father Mengarini to Geo. Gibbs, Esq.; though written some years ago, it is published for the first time in the "Journal of the Anthropological Institute of New York," Vol. i, p. 81, 1871.

Mr. Gibbs states that the frog-wife story exists in a modified form among the Nisquallies and other tribes also, as does much of the remaining mythology of the Rocky Mountains Flatheads. It is noticeable that the Mexicans, according to Garva, quoted by

Gallatin ("Trans. Am. Ethn. Soc.," vol. i, p. 97), believed in the destruction of the world four times by various causes, on each occasion of which the sun also perished, so that the present is the fifth sun.

MICROSCOPY.

GASES AND VAPORS IN MICRO-CHEMISTRY.—Mr. E. Ray Lankester describes in the "Quarterly Journal of Microscopical Science" his gas-chamber, which is a modification of the one used by Schweigger-Seidel. A watch-glass-shaped piece of glass has its edges ground and cemented to a flat plate of glass. The top of the dome thus formed is ground away so as to make a large opening into its cavity, and closed by a thin cover glass which bears the object to be examined upon its under surface and therefore inside of the cavity of the dome. This covering glass is held in position, and the joint rendered air-tight, by means of oil. Into the top and sides of the dome are inserted glass tubes, three in number, through which re-agents, in the form of gas or vapor, are introduced into the dome by means of suction or of pressure. To prevent too rapid drying of the object, as a drop of blood, the gas may in some cases be previously passed through warm water in a Wolff's bottle. Heat may be applied by introducing one end of a stout copper wire through one of the tubes, and heating the end which remains outside, or by similarly introducing a platinum wire connected with the poles of a galvanic battery. In this manner liquids may be vaporized inside of the dome, if desired.

Among the re-agents thus used are water, hydrochloric acid gas, carbonic acid gas, acetic and osmic acids, nitrogen tetroxide, hydrogen sulphide, chlorine, iodine, bromine, ammonia, alcohol, ether, chloroform, carbon bisulphide and carbolic acid.

The advantages claimed for gaseous re-agents are, that some can be used in no other state, that they are applied without a deluging stream which might displace the particles under observation, that the action of diluents (as water or alcohol) is avoided, and that minute traces of the re-agent may be introduced, increased, stopped or counteracted with great facility. The author believes that in chemical histology all re-agents should be applied in the gaseous form, though not exclusively so, if possible.

MICROPHOTOGRAPHY.—A good popular article on this subject is published by Mr. Charles Stodder in the "Boston Journal of

Chemistry." The history and advantages of microscopical photography are well given, though no reference is made to the corresponding disadvantages, such as the unequal applicability of the process to objects of different colors, and the necessity of representing a single focal plane or section of the object, while the different varieties of delineation by hand-work enable the artist, if sufficiently expert to know what he sees, and sufficiently candid to draw what he sees and not what he thinks he ought to see, to reconstruct to some extent the object and represent at a single view the knowledge gained by many slight changes of focus. Unfortunately for their value as tests in this case, the so-called test-objects seem to be particularly suitable for photographic illustration. Of the Woodward photographs familiar to the writer, those of the test-objects are (probably necessarily) more faultless than those of the tissues, and are therefore tests of the corrections of the objectives and of the perfection of the illumination rather than of the general applicability of the photographic process. Of this latter question, but little understood as yet, the researches of Dr. Woodward and others give promise of an early solution.

Mr. Stodder applies the name of microphotograph to the enlarged photographic representation of a microscopic object, such as the well-known productions of Dr. Woodward and of Dr. Maddox, although, since that name was previously appropriated to the reduced photographs for microscopical inspection taken from large objects, some microscopists have recently preferred, for the sake of distinction, to designate the enlarged photographs of small objects by the name of photomicrographs.

Curious Varieties of the Liber. — "The Lace Bark of Jamaica (*Lagetta lintearia*), is composed of a series of concentric layers of very fine and strong fibres, which, by crossing and interlacing each other, form a complete network, the beauties of which are quite hidden till the bark is beaten out, and the fibres partially separated by carefully pulling them in a lateral direction, when a piece of vegetable lace a yard or more in width, will be produced. This natural lace is used in Jamaica for making hats, caps, collars, frills, etc. . . . . The bark of the Paper Mulberry of the South Sea Islands is another of the fibrous kinds; it is very strong and tough, and is used in the Pacific Islands for making what is called tapa cloth, which serves the natives for

various articles of clothing. Another remarkable fibrous bark is the *Antiaris saccidora*, called the Sack Tree in Western India and Ceylon. The bark of this tree is used for making sacs, hence its common name. A trunk is selected of the requisite diameter, and a piece is cut off, of the required length; the bark is then soaked and beaten, loosened from the wood, and turned back or inside out; if it is entirely stripped off, it requires simply to be sewn up at one end, but it is usual to leave a small piece of the wood to form the bottom. The bark is toughly fibrous in the Stringy Bark Tree (*Eucalyptus gigantea*) of Tasmania: while in the Iron Bark it is tough and might be taken for a close-grained wood. The ashes of the bark of the Pottery Tree of Para, whose cells are shown by the microscope to be silicated, is mixed with clay by the Indians, and made into a kind of earthenware which is very useful and durable."—MR. JACKSON, *of the Kew Museum.* From the *Monthly Microscopical Journal.*

LEPIDOPTEROUS SCALES.—Chevalier Huyttens de Cerbecq of Brussels, after careful study of the scales of butterflies and moths, with immersion objectives and transparent illumination of high powers by the paraboloid, is satisfied of the beaded structure of the scales of most insects, if not of all.

Dr. John Anthony describes the markings on the ribs of the "battledore" butterfly-scales as consisting of heads or knobs elevated on stalks. In his plates in the "Monthly Micoscropical Journal" they stand up like door-knobs or like the glandular hairs on some plants. He uses light reflected from a rectangular prism carefully centred, and limited by the diaphragm; and as the appearances are well seen with objectives as low as one-fifth inch, he judges that they will be readily seen by other observers.

GRINDING DIAMOND POINTS.—Mr. F. H. Wenham, with his accustomed liberality which the world will not soon forget, publishes in the "Monthly Microscopical Journal" the method by which a fragment of diamond may be turned in a lathe to a point as fine as a needle. These points are easily prepared, and are the right thing for glass ruling, being used in Peter's writing machine, and probably by Nobert. A splinter of diamond is mounted on the end of a wire, chucked in a bow-lathe, and turned against another splinter similarly mounted. The importance of this suggestion may be inferred from the fact that Mr. Stanistreet, whose machine

was calculated to rule lines to the $\frac{1}{100,000}$ of an inch could not procure any diamond fine enough to rule more than about five thousand to the inch.

VITALITY AS AFFECTED BY TEMPERATURE.— Mr. Grace Calvert found that 300° and sometimes 400° Fahr. are sometimes required to destroy living germs; also that animalcules could live for hours at seventeen degrees below the freezing point of water.

MICROSCOPICAL MANIPULATIONS.— Mr. Stanistreet justly judges that other amateurs will be encouraged by learning that the machinery for ruling his already famous lines was entirely constructed by himself, untaught and unassisted, while confined to the house by illness.

FIBRES OF FLAX AND HEMP.— Mr. Suffolk states that a committee, on which he was appointed by the Queckett Club, undertook the study of these fibres with reference to their discrimination with the microscope in mixed fabrics; but abandoned the work on finding the fibres too much alike to be distinguished.

DARWINISM AND HISTOLOGY.—Dr. Lionel Beale, in his address to the Queckett club, counsels a careful comparative study of the tissues of man and the apes, in order to verify, if possible, the correspondence which has been asserted but not proved to exist between them.

STAINING AND CUTTING LEAVES.— Dr. R. Braithwaite, in his elaborate study of the bog-mosses, stains leaves by immersion from two to twenty-four hours in iodine and sulphuric acid or a solution of biniodide of zinc, preferably the latter. Transverse sections he obtained by soaking the leaves in thick mucilage of gum arabic, and, when partially dried, enclosing between pieces of elder pith and slicing into water.

ALTERNATION OF GENERATIONS IN FUNGI.—Mr. M. C. Cooke reviews, in "Nature," the experiments of Oersted and of De Bary on this subject. Most Uredines have two forms of fruit, but it is exceedingly difficult to prove an alternation of generations in any case. When the spores of fungi are sewn upon a plant, or introduced by inoculation, it is nearly impossible to prove that other fungi subsequently appearing on the same plant owe their presence there to the spores intentionally sewn or inoculated.

Preservation of Fresh-water Polyzoa.—Mr. Stewart explained to the South London Microscopical and Natural History Club that he had succeeded in killing polyzoa with the tentacles expanded by adding a few drops of the best French brandy to the water they were living in. They were overcome by the liquor. without drawing in their plumes.

Crystallization of Metals by Electricity.—This has been studied under the Microscope by Philip Braham, Esq. His apparatus is described in the "Monthly Microscopical Journal," for Dec. 1871.

Conjugation in Rhizopods.—J. G. Tatem, Esq. has observed what seems to be an instance of this hitherto unnoticed, though not unsuspected, process in the case of a common Amœba.

Photographing by Black-ground Illumination.—Dr. Woodward has obtained good high-power photographs (x 1000) of objects illuminated by Mr. Wenham's truncated lens.

Cleaning Diatoms.—Dr. Maddox cleans and bleaches diatoms by immersion in a solution of chlorate of potash and hydrochloric acid.

Microscopical Structure of the Wax or Bloom of Plants.—An interesting study of this familiar substance occurring on leaves and fruits, by Prof. De Bary, is given in the "Botanical Zeitung," with some thirty beautiful illustrations. The wax does not appear to be a simple coating over the surface, as though it might have been laid on liquid with a brush, forming a continuous layer. It is seen to be rather a dense forest of minute hairs of wax; each one sitting with one end upon the epidermis and the other either rising up straight or rolled and curled among its neighbors. This matting of waxen hairs often becomes so dense that when examined from the surface it presents to the microscope the appearance of a continuous layer, while a carefully made section of the leaf, or skin of the fruit, shows its true structure. The question from what part of the epidermis or subepidermal tissue does the wax come, is most beautifully and clearly answered. He says that in the cell-contents there cannot be discovered the slightest trace of wax, and the statement that the chlorophyll is partly made of wax is totally erroneous. The locality

in which it can be first detected is the cuticle and the cuticularized elements of the epidermis cells.—T. D. B.

NOTES.

Prof. Agassiz read a notice of the life and character of Dr. E. Holbrook of Charleston, S. C., before the Natural History Society of Boston, Oct. 18, 1871. He remarked that:—

"The death of Dr. Holbrook has been deeply felt by a very large circle of friends, and by those who are acquainted with the history of science during the last fifty years. But highly as he was appreciated by all to whom he was personally known, and by his scientific peers and colleagues, America does not know what she has lost in him, nor what she owed to him. A man of singularly modest nature, eluding rather than courting notice, he nevertheless first compelled European recognization of American science by the accuracy and originality of his investigations. I well remember the impression made in Europe more than five and thirty years ago, by his work on North American reptiles. Before then, the supercilious English question, so effectually answered since, 'Who reads an American book?' might have been repeated in another form, 'Who ever saw an American Scientific Work?' But Holbrook's elaborate history of American Herpetology was far above any previous work on the same subject. In that branch of investigation Europe had at that time nothing which could compare with it.

Born near the close of the last century, in 1796, Dr. Holbrook entered upon his career as a student at a moment of unusual activity in scientific research in Europe. Although his birth occurred at Beaufort, S. C., he received his early education at the north. His father, himself a New England man, brought him, when only a few months' old, to Wrentham, Mass. There he grew up, and though his after fortunes led him back to his birthplace and the greater part of his life was passed in South Carolina, he remained warmly attached to the home of his boyhood. From school he went to Brown University, and after completing his college course there he studied medicine in Philadelphia, and subsequently practised for a short time with a physician in Boston; but he took a larger and more comprehensive view of his profession than that of the special practitioner, and he went abroad to seek a more general scientific culture. He went through the Medical School at Edinburg, and then travelled on the continent, making himself familiar with methods of study and practice there. But perhaps nothing in all his European journey had greater influence upon his future life than his stay in Paris, where he worked at the Jardin des Plantes, and became intimate with some of the leading scientific men of the day. He formed relations then which ended only with

life, such as his friendship with Valenciennes, with Dumeril, Bibron and others.

On his return to America he was called to the Professorship of Anatomy in the Medical School of Charleston, S. C. From this time Dr. Holbrook, although he became an eminent practitioner in the city which had adopted him, was even more distinguished as a teacher of human anatomy, and finally renounced practice to devote himself to his professorship. Clear, simple and straightforward as a teacher, intimate with the most advanced systems of thought and instruction, he inspired his students with a love of nature, and made them indeed, in not a few instances, naturalists and men of science, as well as physicians. His pupils are among the most cultivated men of the South. His lovable personal qualities endeared him to them, and many of his students lost in him not only a revered teacher, but a well beloved friend."

The Officers of the Boston Young Men's Christian Union, recognizing the importance of scientific studies, and the need of encouraging scientific tastes, have determined to establish in the rooms of the Union a Natural History cabinet. Their object in providing such a collection, is to foster the growing taste for science among the young men of Boston, and to open a new source of instruction and amusement to the members of the Union.

The cabinet will be in charge of Mr. F. W. Clarke, and contributions to start it are earnestly solicited. Specimens should be sent, carefully packed, to the care of F. W. Clarke, B. Y. M. C. Union, 300 Washington Street.

In compliance with a repeatedly expressed desire, the Smithsonian Institution has determined to make more frequent transmissions to Europe of exchanges of books, and announces that it is prepared to receive parcels at any time, with assurance of speedy delivery, at least to the more important addresses, upon the following conditions, which must be strictly observed:

1. Every package, without exception, must be enveloped in strong paper, and secured so as to bear separate transportation by express or otherwise.
2. The address of the institution or individual for whom the the parcel is intended must be written legibly on the package, and the name of the sender must be written in one corner.
3. No single package must exceed the half of a cubic foot in bulk.
4. A detailed list of addresses of all the parcels sent, with their contents, must accompany them.
5. No letter or other communication can be allowed in the par-

cel, excepting such as relates exclusively to the contents of the package.

6. All packages must be delivered in Washington free of freight and other expenses.

Unless all these conditions are complied with the parcels will not be forwarded from the Institution; and, on the failure to comply with the first and second conditions, will be returned to the sender for correction.

Specimens of natural history will not be received for transmission, unless with a previous understanding as to their character and bulk.

Our contemporary, the "Revue Scientifique" (Jan. 13, 1872, p. 679) in analyzing a paper by one of the editors of this journal, has made several mistakes, one of which we might notice. It says "Mr. Packard rejects in consequence the idea of Fritz Müller and Brauer that the primitive insects had all leptiform larvæ, and were not afterwards modified to produce insects with eruciform larvæ." On the contrary he agrees with the opinion of Müller and Brauer that the earliest insects were those with an incomplete metamorphosis, quoting with approval Müller's note to that effect.

In a previous number (Sept. 23, 1871, p. 300) Dr. Packard is made to say "that the king crabs are nearer the Trilobites than Pterygotus." He has never said this, but on the contrary follows Mr. Woodward in uniting the king crabs with the Eurypterida, of which Pterygotus is a member; considering the king crabs as on the whole much more remotely allied to the Trilobites than to the Eurypterida.

Entomologists will be pleased to learn that Mr. R. H. Stretch of San Francisco is now ready to begin the publication of "Illustrations of North American Zygænidæ and Bombycidæ" in which he hopes to be able to figure all the North American species. The first plate, containing eight species of Alypia, six of Ctenucha, one Scepsis and a Psychomorpha are in the hands of Miss Peart of Philadelphia to be lithographed. Mr. Stretch proposes to figure the species as he can procure them, and so to arrange the letter press that it can be bound in proper order. The book will be uniform in size with the transactions of the American Entomological Society. The value of such a work will largely depend on the aid rendered to Mr. Stretch by museums and individuals, and

we trust he will receive every encouragement. At any rate many interesting and rare Californian species will be figured, which will make the work of much value to students.

The second edition of the "Guide to the Study of Insects" having been exhausted, a new and improved edition will appear late this month. Several new plates and cuts will be added, and an appendix, bringing the work down to the latest date. The price will be reduced to five dollars.

A Natural History Society is flourishing at Natick, Mass., and is now growing rapidly, having a membership of seventy. Its museum is gaining accessions, and already needs more room for cases.

It is proposed to add a department of Science to the Executive Branch of the Government. It is to be composed of the Storm Signal Corps of the army, the Lighthouse Board, and the Coast Survey Bureau of the Treasury, and the Hydrographic Bureau of the Navy.

A communication to the Corporation of Brown University was recently presented from Colonel Stephen T. Olney, making a munificent offer of his herbarium and books on botany, on condition that a suitable building should be provided for their reception. It was referred to a committee.

Dr. W. Stimpson writes us from Key West, Florida, under date of January 15, "To-morrow I leave here in the U. S. Steamer, "Bibb" Capt. Robert Platt, to run a series of dredgings between Cape St. Antonio (Cuba) and Cape Catoche (Yucatan), and I anticipate most interesting results, as Capt. Platt has had three years' experience in deep sea dredging with Pourtales. We expect to get into two thousand fathoms at least."

EXCHANGES.

Botanical microscopic objects (mounted) also herbarium specimens of mountain and sea-shore plants, desired in exchange for U. S. herbarium specimens.—Rev. H. G. Jesup, *Amherst, Mass.*

Diatomaceous Material, fossil or recent, desired in exchange for mounted diatoms from Western localities.—H. H. Babcock, 11 18th *St., Chicago, Ill.*

Azolla and other Hydropterides (living specimens) desired in exchange for fresh water algæ or mounted microscopic objects.—T. D. Biscoe, 321 *George St. Cincinnati Ohio.*

Microscopic Fungi, mounted or unmounted, desired in exchange for microscopic slides or herbarium specimens.— C. E. Hanaman, 103 *First St., Troy. N. Y.*

TWO FRUSTULES OF

AMPHIPLEURA PELLUCIDA,

MAGNIFIED 1500 DIAMETERS.

PHOTOGRAPHED BY

DR. J. J. WOODWARD, U. S. ARMY,

AT THE ARMY MEDICAL MUSEUM.

Objective by WM. WALES, Fort Lee, N. J.

THE

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THE USE OF AMPHIPLEURA PELLUCIDA AS A TEST-OBJECT FOR HIGH POWERS.

BY DR. J. J. WOODWARD. U. S. A.

OVER a year ago (February 1, 1871) the Surgeon General of the United States Army published a brief memorandum prepared by me, on the *Amphipleura pellucida* and its markings. This memorandum was accompanied, by two photographs exhibiting the striæ of the diatom, as seen with a power of about one thousand diameters. The paper was republished in the "American Journal of Science and Arts" (May, 1871), and in the "London Monthly Microscopical Journal" (July 1871).

Since preparing the memorandum referred to, I have had occasion to use the *Amphipleura pellucida* a number of times as one of the means of comparing the high power objectives of various makers, and having found it, within certain limits, well adapted to this purpose, have thought the following remarks on its use would not be without interest to working microscopists.

Specimens mounted by various English preparers may readily be obtained from any of the large dealers in microscopical preparations. I have compared such modern slides with some of the original ones mounted by Messrs. Sollitt and Harrison, which I owe to the courtesy of Mr. W. S. Sullivant of Columbus, Ohio, with the sample in the first century of Eulenstein, and with other slides from various sources. I find all very much alike, the striæ usually varying from ninety to one hundred to the $\frac{1}{1000}$ of an inch. In a few large frustules I have found coarser striæ than the above

but finer ones in none. For the best use of the test it is essential that the frustules should be clean and mounted dry,* on the under surface of a very thin cover (not thicker than $\frac{1}{200}$ of an inch). In some of my slides the frustules are mounted between two thin covers, adhering to the upper one but I am not sure that this arrangement offers any decided advantages.

The first step in the practical use of this test, after obtaining a properly mounted specimen, is to select a frustule, to count the number of its striæ to the thousandth of an inch, and to record its position with a Maltwood's finder.

The frustule thus selected becomes a valuable unit of comparison between different objectives, the distinctness with which the striæ are shown indicating the definition of the glass, the manner in which the edges of the frustule are seen while the mid-rib and striæ are in focus showing the degree of penetration, and the appearance of the ends of the frustule when the centre is in focus giving a fair idea of the flatness of the field.

The illumination must be oblique, and the pencil of light must be thrown lengthwise along the frustule, which may be done by a common coal-oil lamp, with or without a small plano-convex lens, or other condensing apparatus, to concentrate the rays. This, however, is the least favorable mode of illumination, and will only succeed if very carefully used with the best objectives. Much better are the calcium and magnesium lamps, which may be condensed obliquely by means of a small plano-convex lens of one to three inches focal length. Either source of light gives a beautiful picture, the striæ being black on a white ground. The finest

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*This is essential to the *best* and *most beautiful* appearance; it is not, however, indispensable for resolution, nor does balsam mounting make resolution much more difficult. For example I obtain excellent resolution of the balsam mounted *Amphipleura pellucida* on the Museum Möller's type-plate by Beck's immersion 1-10; price £6 sterling. The striæ are distinct and easily counted but paler than on dry specimens. I desire, also, to draw attention to the fact that Count F. Castracane in a paper read before the Royal Microscopical Society, March 1, 1871, expressly states that the year before he had made a photograph of the balsam-mounted *Amphipleura pellucida* of Möller's type-plate, obtaining good resolution and counting the striæ, which he gives as 4,000 to the millimetre. For this purpose he used a No. 10 of Hartnack, illuminated with monochromatic sunlight obtained by a prism. His negative "was blurred and rather faintish, so that it would not give good positive images." The power was about 640 diameters. Afterwards he obtained the same results with a No. 10 of Nachet (Monthly Microscopical Journal, April, 1871, p. 176). I may add that the Hartnack's No. 11 belonging to the Museum (price 250 francs) gives excellent resolution of the Amphipleura of Möller's type-plate and of other balsam-mounted specimens belonging to our collection.

results, however, are attained by the light of the electric lamp or of the sun rendered monochromatic by passing through a saturated solution of the sulphate of copper in strong aqua ammoniæ and of about the eighth of an inch in thickness.

Of these methods, that by sunlight involves least trouble and expense, and may be best managed as follows:—Erect a perpendicular wooden screen about two feet square on one edge of a small table. Cut in this a circular hole an inch and a half in diameter at about the height of the under surface of the stage of the microscope. On the outside of this hole mount a small plane mirror which can be adjusted by passing the hand to the outside of the screen. On the inside, cover the hole with the ammonio-sulphate cell. (A piece of dark blue glass will answer the purpose though not so well.) Now move the table to a window through which the direct rays of the sun can fall upon the mirror, adjust this so as to throw a nearly horizontal pencil of parallel rays through the hole, and place the microscope in the shade of the screen in such a position that the parallel blue rays will fall on the under surface of the amphipleura slide at an angle of from fifty to seventy-five degrees with the plane of the slide (I suppose the frustule to be examined has first been found by ordinary day-light or lamp-light). Next place a small bull's eye or any other condenser of from one to three inches focal length (mounted on a separate stand or on a radial arm) in the parallel pencil in such a position as to concentrate the light, at the angle above indicated, upon the frustule under examination. After this nothing remains but to regulate the cover correction and the fine adjustment. The precise angle which should be given to the illuminating pencil will vary with the angle of aperture of the objective used. As a rule it should be less than half the angle of aperture of the objective, and 70° to 75° is the maximum angle which should be given even for objectives of 170° angle, a greater angle, distorting the image without improving the definition.

The same results can be obtained by using a heliostat to fix the direction of the solar rays, and obtaining obliquity by an achromatic condenser of from 130° to 150° suitably decentred. On account of the stability of the illumination this method is especially suitable for photographing the Amphipleura, but the simpler method above described answers every purpose if the object is to compare objectives.

As to the result I may say that I have not yet met an immersion lens by any first class American, English, or Continental maker of an actual focal length of $\frac{1}{8}$ inch or less which did not, in my hands, resolve the Amphipleura more or less satisfactorily. I have even succeeded with an immersion $\frac{1}{5}$ of Mr. Tolles' obtaining a good photographic negative of two frustules well resolved with only two hundred and fifty-six diameters. My friend, Dr. J. W. S. Arnold of New York, writes me that he has obtained resolution by a Wales's immersion $\frac{1}{6}$.

A great difference exists, however, as to the manner in which different objectives, even when of the same power and by the same maker, will exhibit them, and for myself I have obtained the best results only with the finest immersion glasses of Messrs. Wales, Tolles, and Powell and Lealand. Spencer's recent objectives I have had as yet no opportunity of trying. With dry objectives the task is more difficult, still I have succeeded tolerably with some of the dry objectives of the above makers, and it was as seen with dry objectives that Messrs. Sollitt and Harrison first observed the striæ, though they could have glimpsed them but imperfectly or they would not have set them down at one hundred and thirty thousand to the inch.

In illustration of the appearances which ought to be obtained by a first class immersion objective of adequate power, the liberality of the Editors of the NATURALIST enables me to present herewith a Woodbury print from a negative, representing portions of two Amphipleura frustules as seen by an immersion objective of Mr. Wm. Wales of Fort Lee, New Jersey, magnified about fifteen hundred diameters. The lower of the two frustules proved on a careful count in the microscope, to have ninety-five striæ to the $\frac{1}{1000}$ of an inch. This circumstance puts it in the power of every one to compare the two frustules, and to determine the precise magnifying power of the print.

The objective used was made by Mr. Wales nearly three years ago. It was named a $\frac{1}{50}$ but is in fact a lower power. On measurement I obtained the following data. Magnifying power, without eyepiece, at fifty inches distance from micrometer to screen eight hundred and ninety diameters uncovered, twelve hundred and fifty diameters at full correction for cover; angle of aperture at uncovered 110°, at full cover 130°; at uncovered the objective is, therefore, $\frac{1}{18}$ very nearly.

The photograph was taken without an eyepiece, the magnifying power being obtained by distance; owing to the moderate angle of the objective the picture was freer from diffraction fringes and consequently handsomer than any Amphipleura picture I had previously obtained, for this reason only it was selected for reproduction. Since it has been in the hands of the printer, however, it is only fair to say that I have obtained equally beautiful pictures with the same power by an objective made by Tolles of 140° angle, as well as by an objective of Powell and Lealand, both used without eyepieces. Copies of these pictures I have sent to the Editor of the department of microscopy of this journal for exhibition. I suspect each maker would claim that the picture by his objective was the best. For myself I regard them as nearly equally good, and think that to discriminate slight shades of excellence between objectives of this high grade, it is necessary either to give a much higher power, by distance or eyepiece, or else to use some more subtile test, such for example as the finer bands of the Nobert's plate.

My present object is not to advocate one maker or another, but to present an image of what the best glasses of several excellent makers will do with ease if properly handled, and to those who are influenced by more partisan feelings I need only suggest that less than two years ago no American microscopist had been able to see any striæ on this well marked diatom, and that those who had made the attempt were disposed to regard the observations of the Hull naturalists, made over ten years before, as quite fictitious.

In conclusion I need only mention that the illustrative print was reproduced from my negative by "The American Photo-relief Printing Company" No. 1002 Arch Steet, Philadelphia, Pa.

WHAT IS TRUE TACONIC?

BY PROF. JAMES D. DANA.

THE true use of the term Taconic should be learned from Prof. Emmons's first application of it when he made his formal announcement of the "Taconic system." In his final New York

Geological Report, 4to., 1842, the rocks so-called are those of the Taconic mountains, on the borders of Massachusetts and New York, together with the quartzite, limestone, and slates adjoining on the east,* and not the slates far west of these mountains;† moreover the slates, the rocks of the mountain, were the typical beds, and not the quartzite. Hence, if there are any Taconic schists or slates, those of the Taconic range are the rocks entitled to bear the name, being Taconic geographically, and Taconic by the earliest authoritative use, Prof. Emmons the authority.

Prof. Emmons, in his Agricultural Report, subsequently published (in 1843), announced the Primordial beds of Bald Mt. (near Canaan Four Corners, in Columbia Co. N. Y.), as *Taconic* also; but this did not make them so. He referred to the Taconic the Black slates of northern Vermont, since shown to contain primordial fossils; he searched the country north and south for other Taconic rocks, and found them as he thought; and he set others on the search, not only in this country, but over the world. But all this has not changed the fact that the true Taconic beds, if any are such, are those he first so announced; and that the rest, so far as they are of different age from these, younger or older, have been dragged into the association without reason. The Taconic rocks of Berkshire and of the counties of New York just west always bore the most prominent part in his later descriptions of the Taconic system.

The error on the part of Prof. Emmons, in referring beds of other ages to the Taconic system, is not surprising considering the difficulties in the case. But it was no less an error; and his name as a backer cannot make the wrong right.

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* Professor Emmons opens the subject of the "Taconic System" in his final Report (1842) by saying that it extends north through Vermont to Quebec, and south into Connecticut; but the only rocks he describes as the rocks of the system are those of Berkshire County, Massachusetts, and their continuation westward into New York. These are the typical rocks on which the system was founded. On plate xi. four figures representing sections across this particular region are given. The only Vermont observations are contained in the only other section on the same plate representing a section from Lake Champlain to Richmond, Vt., through Charlotte. No description of the rocks of this section is to be found in the text of the volume.

† In figure 4 of plate xi (referred to in the preceding note) representing a section through Graylock, the "Taconic slate" stops just west of Berlin. Rensselaer County. New York. the slates on the west being put down as "Hudson River shales," and in figs. 2 and 3, the boundary is near Petersburg, north of Berlin. The extension of the Taconic to the Hudson River appears first in Prof. Emmons's Agricultural Report, published in 1843.

Geologists now regard the slates of Taconic Mt. and the limestone, also, as of Lower Silurian age, but later than the Potsdam sandstone. Logan refers them to the Quebec group. Whatever the period of the slates, or slates and associated limestonės, to that period properly pertains the term *Taconic*.

THE STONE AGE IN NEW JERSEY.

[Concluded from March Number, p. 160.]

BY CHARLES G. ABBOTT, M.D.

ARROWHEADS.—No one class of relics of a savage race presents at once so great a variety of shapes, sizes and materials; and the former presence of "Indians," is more generally known to the people at large through the frequent occurrence of these arrow-points, than by means of any other style of weapon or implement; not even excepting the cumbrous axes that not unfrequently go to make up the piles of cobblestones that accumulate in field corners or by the roadside. One of the largest axes we have seen, which we have since sent to Sir John Lubbock, was found supporting a section of worm-fence, where it had been lying thus for at least a century.

These arrowheads, which are found scattered over every portion of the state, are, very naturally, much more numerous in some localities than in others; and as no one style appears to be peculiar to any one locality, a good series from even a very limited extent of country will usually represent the shapes and sizes found over the whole state. Any attempt at classification will prove a desperate undertaking, as no well marked style has yet been found which has not been duplicated by a second, varying a mere trace, and these slight variations go on without a break until the two extremes of shape are found to be connected by an unbroken chain of closely allied varieties. The Darwinism of arrowheads needs no supplemental theory to make it good, nor are there shapes that cannot be explained by a somewhat similar and more primitive one. Prof. Nilsson ("Stone Age in Scandinavia," Eng. ed., page 43) says "we may divide arrowheads into such as have,

and such as have not, a tang or projection for insertion into the shaft." Referring to Lubbock, in "Prehistoric Times," we find him, on page 98, quoting Sir W. R. Wilde, who divides the arrowheads' into five varieties. Further reference to the two works quoted above shows us, in the drawings, that whatever they have

Fig 31

Natural size.

illustrated from the north of Europe or from Terra del Fuego is also to be met with here in New Jersey. We propose, in figuring the various shapes that we have so far met with, to follow Prof. Nilsson in separating the specimens into those with and without tangs or projections; but we cannot undertake to follow him farther, where he specializes certain forms as harpoonpoints, etc., etc. That some were used as spears, as weapons in battle, and others as hunting spears, or for fishing, *i. e.*, harpoonpoints, is probably beyond question; but that they were not or could not have been used as arrowpoints is difficult to disprove; and while we propose to speak of certain specimens in order, as to their probable use, we will call them all "arrowheads." Ethnologists can reject

Fig. 32.

Natural size.

Fig. 33.

Natural size.

Fig. 34.

Natural size.

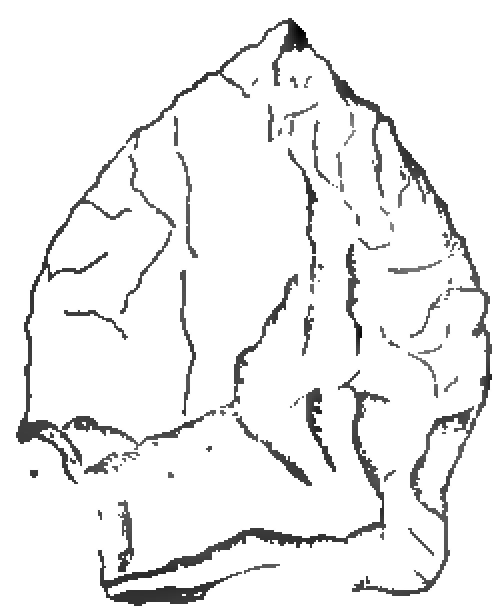
the text if they see fit, but we trust the illustrations will be interesting to those who desire to study them carefully, and with whom specimens are scarce. Arrowheads with tangs or projections for insertion into the shaft are somewhat less abundant than those without the projection; but they are of far greater variety of outline, and vary more in their size, running into spear or harpoon-

points. The most common shape of tanged arrowpoint is the small jasper specimen given in Figure 31. Unlike some forms,

Fig. 35.

Natural size.

Fig. 36.



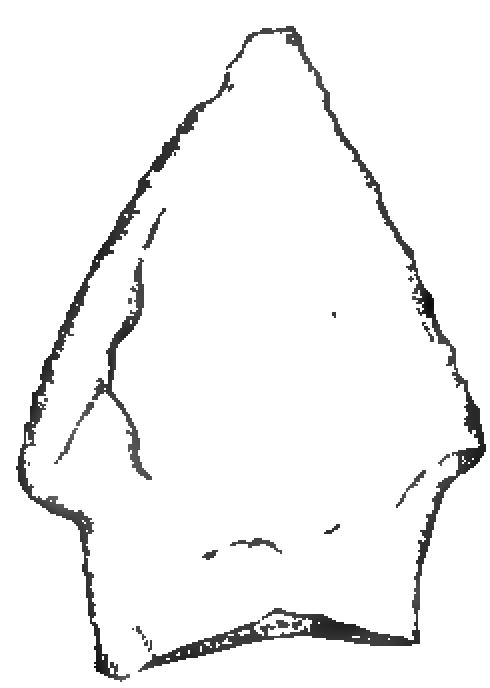
Natural size.

there can be no question as to the use to which this specimen was most admirably adapted as that of an arrowhead. The sharp point, well defined edges and deeply notched base, com-

Fig. 37.

Natural size.

Fig. 38.

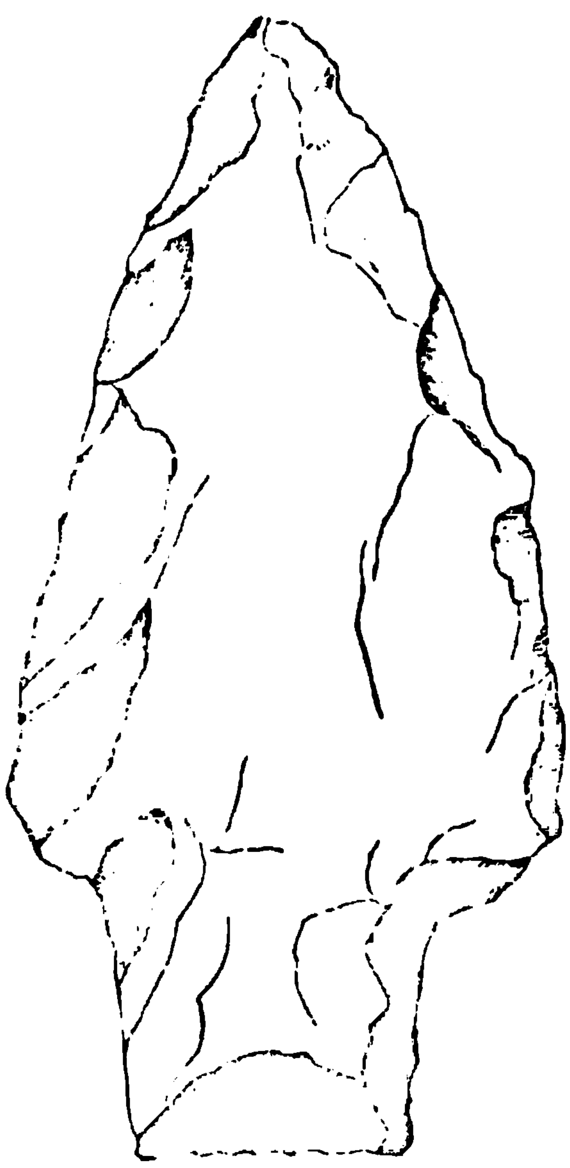


Natural size.

bine to render it at once secure in its attachment to the shaft, and efficacious as a weapon when discharged from a bow.

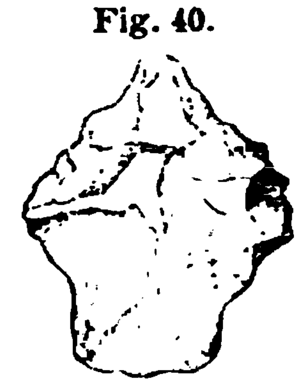
Of this pattern there is a remarkable uniformity in size, and the vast majority of specimens found are of jasper. A second form with a notched base is represented by Figures 32 and 33. Like the above, this form does not vary much in size, and is usually of jasper, but by no means invariably of that mineral. Slate was considerably used, but accuracy and general elegance of outline were not secured in using that material. We think that there can be no question as to these being used exclusively as arrowheads, but the same shape of greater dimensions would have been efficacious as harpoonpoints. The specimen (Fig. 33), it will be noticed, has serrated edges. This is a not uncommon feature of many of the smaller specimens, but generally these serrated specimens are broken. A careful study of over a hundred examples has explained this, we think. In comparison with the same type with smooth edges, we find that they are invariably much thinner. To secure the serrated edge, it was probably necessary to make them so; and of course these thin specimens were more frequently broken in the manufacture and more liable to injury in the daily wear and tear to which they were subjected. A third form of notched arrowheads with a projecting base is seen in that figured in the illustration (Fig. 34). In general appearance it is much like the preceding, but the object of the notch in the centre of the base below does not appear. The specimen is of a black, slaty stone, thin, with the sides indistinctly serrated. We have met with no similar figure in any work on the subject of stone weapons. In New Jersey, at least about Trenton, they are found occasionally, a dozen or more examples having been seen by

Fig. 39.



Natural size.

Fig. 40.



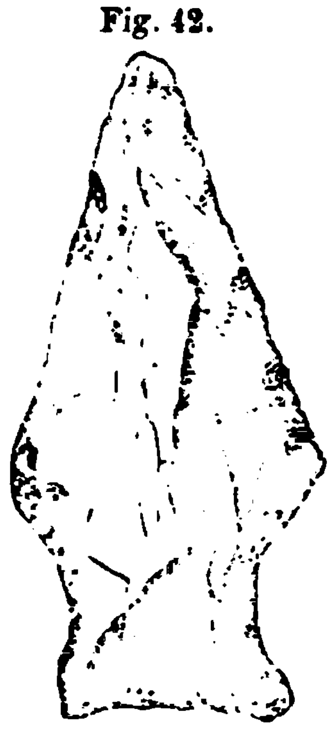
Natural size.

Fig. 41.

Natural size.

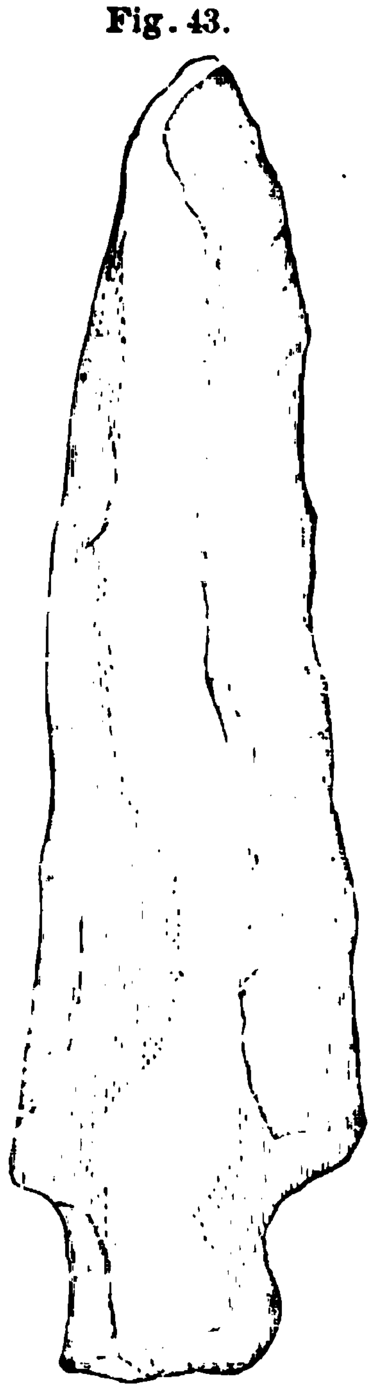
the writer. Of these specimens there was no variation in size, mineral, or peculiarity of base. A fourth form, and a very common one, is that given in the five illustrations (Figs. 35, 36, 37, 38, 39). In these examples we see the one common character of an unnotched base, and that the blade of the arrow is considerably wider, the width increasing abruptly in three specimens and less so in the other two. The specimen (Fig. 35) is of jasper, beautifully wrought, and very accurately bevelled from the centre to the edges, which are smooth. The length, one inch and three-quarters, decides its use, that of an arrowhead only. The specimen that approaches this most nearly is that given in Fig. 39. This is made of sandstone and is one and three-quarters times as large as the former. It is well made, considering the material, and if used as an arrowpoint must have required a very heavy shaft and powerful bow. A series of specimens, figured by Prof. Nilsson as coming from Mexico, Ireland, and Terra del Fuego, and all bearing considerable resemblance to the illustration we have given, are called, one an "arrowhead," another a "harpoonpoint." We will leave it to be decided in future, if it can be, to which class this specimen really belongs. Fig. 38 is a modification of the preceding, about two-thirds the length, and of similar mineral. It is not as frequently found as the other, but is not a rare form. It appears to us to be better adapted to arrow purposes, but is nevertheless well adapted to use with a stouter shaft than an arrow and wielded as a javelin. Figs. 36, 37, 38 and 39 are further illustrations of this type of based arrowhead, all of which have some peculiarity of their own. Fig. 40 is the natural size of a form that is occasionally found. It does not appear ever to have been more acutely pointed or

Fig. 42.



Natural size.

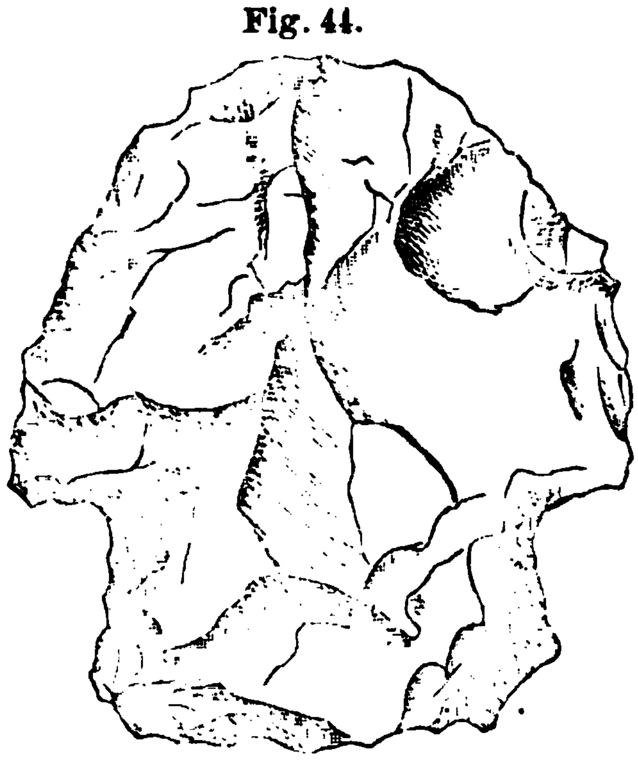
Fig. 43.



Natural size.

sharper sided than now, and is an innocent looking affair. It is as difficult to conceive of the use of so small a specimen as it is to conjecture how the larger ones were utilized. Yet they occur in sufficient numbers to show that they had an especial adaptation. We cannot look upon them as toys for prehistoric infants; there is too much work about them for that. The following figure (41) is of similar dimensions, but appears to us better outlined for an arrowhead. On a slender reed, if discharged with force, it would unquestionably bring down a large bird or squirrel. A much larger and very accurately outlined style of arrowhead is that illustrated by Fig. 42. These are never well finished except in outline, are of slate and rough and uneven on their broad surfaces. This occurs from the peculiarities of the mineral. It is not an abundant form. Beautiful quartz arrows of nearly the same general shape as the preceding, but much more finished specimens, are frequently found. Quartz seems to have been a very favorite mineral with the ancient arrow makers, and almost every shape we have found in other minerals is reproduced in this, except that they are almost always small, and so were used only as arrowheads. Figure 43 is a prevailing style of arrowhead, three and a half inches long, and one inch in breadth at the base of the blade. It is of a slaty stone, and from great age or other causes has lost its acute point and well sharpened edges. The base is similar to that of the slate arrowhead above described; and appears to be sufficiently large to render a secure attachment to a shaft feasible. If originally as sharp at the point and along the edges as are some jasper specimens, it was then capable of doing considerable execution. They are quite abundant, but their shape has rendered them very liable to be broken, especially on stony ground; and we therefore find the majority of this pattern in a more or less fragmentary condition. Figure 44 is a style of arrowhead that presents one marked peculiarity. It has no point. Otherwise agreeing very well with Fig. 36, it has that difference

Fig. 44.



Natural size.

Originally it had a point; of this we feel confident, but as this is the most fragile portion of an arrowhead, of course it is the most likely to be broken and such has here been the case; but the weapon was still deemed worthy of preservation, and has therefore been chipped to an edge, where the fracture took place. Whether used as an arrowhead afterwards or not, may perhaps be questioned. The specimen as it now is certainly bears much resemblance to certain chipped jaspers, to which we will call attention hereafter. They are of frequent occurrence and vary very much in size, as though all sizes of arrowpoints were occasionally thus repaired, even the pigmy specimens that we have already figured and described.

Fig. 45.

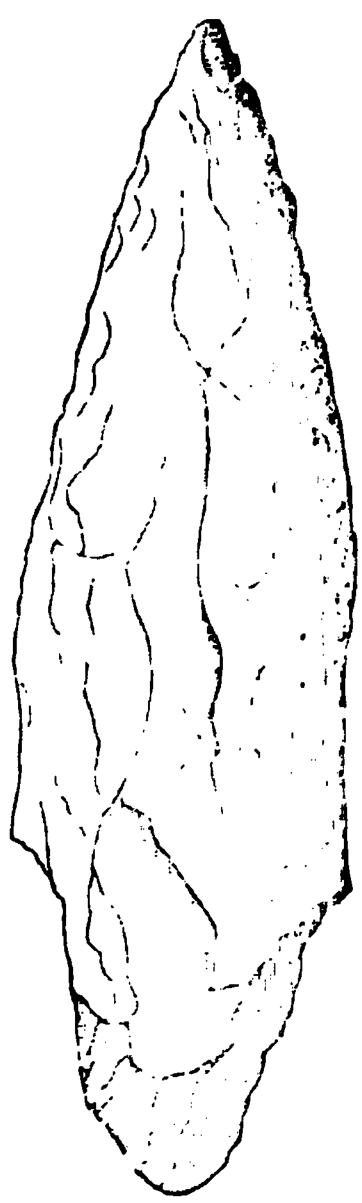
Natural size.

An interesting and quite abundant form of arrowhead is that given in Fig. 45. They occur of every variety of mineral that has yet been met with by us, in the shape of "relics," but the very great majority are in a fragmentary condition, usually only the base and a small portion of the shaft remaining. The specimen figured is of jasper and is remarkably perfect. The point is somewhat blunt, but the edges are pretty sharp. The slender stem is as thick as broad, and there is but little tapering from the quadrangular base to the point. In June, 1871, we forwarded three perfect and several broken specimens of this form to Sir John Lubbock, who has since written us—"As to the long pointed forms of which there are three nearly perfect specimens, besides some fragments. . . . . . I am disposed to regard them as arrowheads, but would only express this opinion under reserve." There is every reason to believe that the first owners of these stone implements were moderately careful of them, and no little skill was required to work them successfully out of the materials they used. Taking this into consideration, we believe it is safest to give to a specimen that name which expresses the use involving the least risk. Now such a specimen as this is assuredly very easily broken, although this has stood safely the exposure of several centuries. To be placed in the end of a spear handle, and used as such, to thrust at fish, etc., would involve more danger of its being broken, than if placed at the end of a slender shaft it was shot into the side of

some animal or bird, and so secured unharmed for future use. Theorizing in this way, we believe, without reserve, that this form was exclusively used as arrowheads.

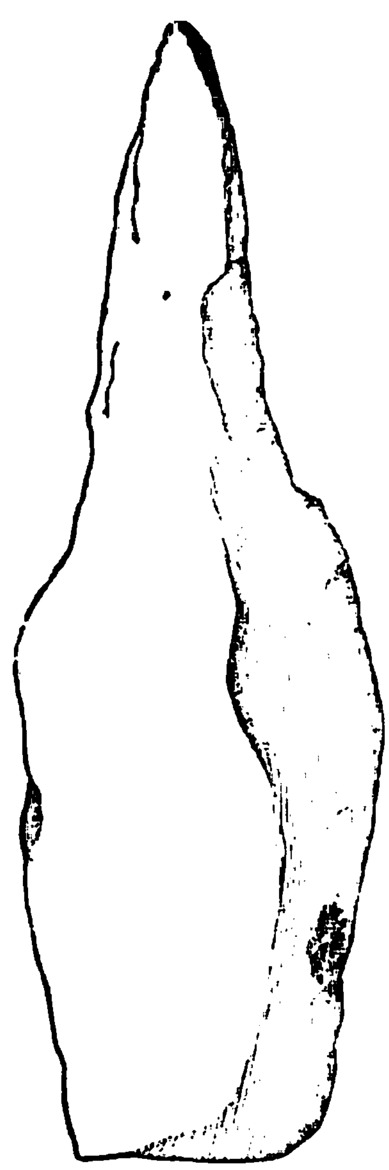
A decided variation from the square tanged arrowheads, is illustrated by Fig. 46 which represents a large arrowhead, admirably chipped from flint, or a bluish gray mineral resembling it. While we have occasionally met with specimens like it in our own neighborhood, it is really a "sea-shore" form and was probably largely used in shooting or harpooning fish. Along the shore of Delaware Bay and in Delaware, near the break-water, and in similar

Fig. 46.



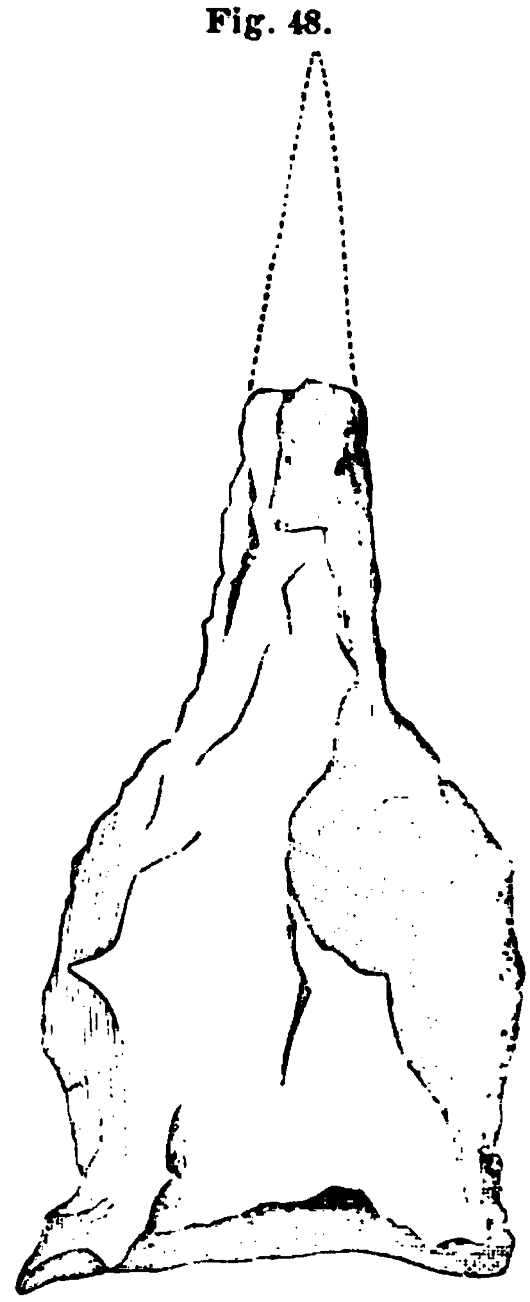
Natural size.

Fig. 47.



Natural size.

Fig. 48.



Natural size.

localities, it is the prevailing form. Three inches long, and but seven-eighths in width, it has a very acute point, and would offer but little resistance to the water. The tang is so shaped as to permit of its being securely fastened to a shaft, and yet easily removed. The specimen is beautifully reproduced in every feature, but length, in quartz specimens. In quartz, this style is abundant, and its size shows it was used only as an arrowhead, in ordinary upland hunting.

Figures 47 and 48 represent two allied forms of slender stemmed arrowheads, allied to each other and to the preceding two varieties. They are of slate, moderately well made and of a length that suggests the spearhead as well as arrow. They are, neither. as frequently met with as the preceding forms, with prolonged stems; but cannot be called rare forms. It has been suggested by an esteemed contributor to the NATURALIST, that these broadly based forms were used as target arrows, the stem only perforating the target, and so they were not lost. But we do not believe so much work would be spent upon arrowheads, for such a purpose only, and opine the prehistoric infants learned to shoot by other methods. Indeed, such must have been the mode of life at this time, that it was a matter of killing or starving, and under such circumstances man's capabilities to climb, run or shoot correctly are very quickly and thoroughly developed. Indeed, correctness of aim may have been inherited then, as well as faculties we now possess are inherited by us.

Fig. 49.

Natural size.

Figure 49 represents a variety of arrowhead, of which we have only seen the one specimen. Beautifully wrought in dull green jasper, it has the slender stem of the immediately preceding forms, with barb-like projections immediately above the base. It is most unfortunately broken, so as to render it impossible to determine all its features. Probably, the barbs were not repeated lower down, and the specimen was broken very near the original termination. Unlike the other elongated-stemmed specimens, this is thin and flat, and the whole aspect is that of a delicate, easily broken form. This fact makes us doubtful about its use as an harpoonhead; although it would be most admirably adapted for such use had the base been sufficiently prolonged to permit the side projections to operate as barbs. We do not find in Nilsson's work on the "Stone Age in Scandinavia" any harpoon-point that resembles this, which more naturally suggests that use, than any of the specimens he figures as having been so used. It

seems incredible that a form so easily destroyed as this should finally have been picked up in its present condition, in a very stony field that for a century has been under uninterrupted cultivation. We have to refer to one more form of arrowhead with projecting base. For delicacy of finish and beauty of outline it is unequalled. As will be seen by the illustration (Fig. 50), the base is broken off, but we can feel confident that it was sufficiently prolonged to enable the very accurately finished barbs to be effective. We imagine the prehistoric hunter who supported a quiver of arrows with such heads as these did not waste them on small game. However great the skill of an arrow maker, to turn out such work was undoubtedly a tedious operation.

Fig. 50.

Natural size.

The second great division of arrowheads, which furnishes less variety in shape, is simplified in its study by the greater uniformity of size, and there is proof from this alone that their use was for shooting purposes only. We have not yet collected a single plainly based specimen, *i. e.* without a tang, that was too large to seem fitted for arrow purposes, or by its size suggested any other use. This class may be further subdivided into such as have straight, convex or concave bases. The largest number belong to the last series; the next in number to the second series and the fewest specimens are those with straight bases.

These remarks on relative abundance are liable to be upset at almost any time. As in the case of axes, so we occasionally meet with "deposits" of arrowheads;" the storehouse, as it were, of a tribe or perhaps of an arrow maker; and as in such cases there is always a predominance of one form, so it may be that other collectors have a majority of straight based specimens from their locality; or a future "find," will change the relative proportions which we have given. No predominance of any one form, however, marks the site of the dwelling and workshop of the arrow maker. In some cases the variety is wonderful; and the broken, unfinished specimens suggest that variety was continually aimed at by the "flint chipper." We have seen several forms at such a locality, that we have not yet met with in a finished state.

These sites of skilled arrow-makers' workshops were usually on projecting points or bluffs overlooking a broad expanse of country; and when once visited, are known immediately by the countless numbers of thin, splintery flakes that cover the whole ground. One such place in particular had evidently been so occupied for many generations, or by a score of arrow makers during their lifetime, considering the vast amount of chips and refuse material on the ground. It was a paradise for the mineralogist, for all our mineral productions, suitable for chipping, seemed to be there in abundance. After a rain, when the chips were free from dust, the many colored jaspers presented a beautiful appearance. Isolated specimens of minerals, available for arrow making, are frequently found in the fields, that do not belong there according to the given "localities" of mineralogists. One of the finest agates we have ever seen, was a partially chipped mass found just beyond the town limits of Trenton, N. J.

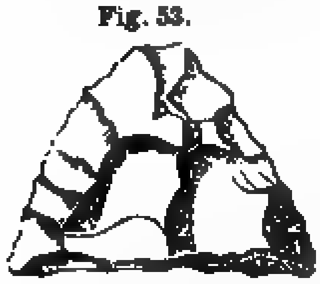
Fig. 51.

Natural size.

Fig. 52.

Natural size.

Fig. 53.

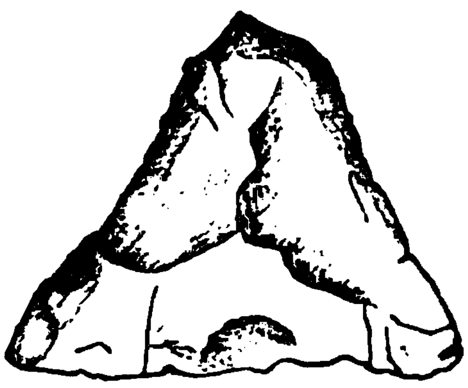


Natural size.

Triangular arrowheads, with concave bases, are very abundant and present some little variations in detail. Figure 51 is a beautiful specimen of one of these varieties, and is of a shape and size that we frequently meet with. They are mostly of black quartzose stone, or cut from a hard piece of slate. The specimen figured is of yellow jasper, with veins of white quartz running through it. A second illustration of this form, giving about the minimum size, is that of Fig. 52. It is one of the handsomest specimens that we have ever seen. It is cut from a greenish gray jasper, and remains in its perfect condition. Like the preceding this size and form also is mostly represented by black specimens cut from hard stone, but one that is much more brittle than is this many colored jasper, of which so many of our arrowheads have been made. A third variety of this class of

arrowheads, is given in figure 53. The base is so slightly curved as to make one doubt where to place the specimen. It is very nearly an equilateral triangle, but is particularly to be noticed, in that it has not been made with a well defined point; or if so originally, has since been sharpened down to a curved edge, and again used as an arrowpoint. Such arrowheads must have been shot with tremendous force to render them effective, for the cutting edge is never sharp as points that have been chipped; and as they now are, these curved topped specimens seem better adapted to crush than to penetrate. The specimen described is cut from yellow jasper or a mineral approaching it. It has not the gloss that jasper usually has. A variation of the form immediately preceding this, is given in Fig. 54, of slate, but well cut: this style is very sparingly met with. The peculiarity, as will be seen at a glance, consists in the manner in which the point has been chipped. A single specimen of this style would probably excite no comment. The peculiarity would be considered as resulting from a chance blow of the arrow maker. This however is proved not to be so from the fact that a score or more have been gathered, each, in size and mineral, the fac-simile of the others. It is probable that one maker may have fashioned all that we have found, and the style originated and died with him.

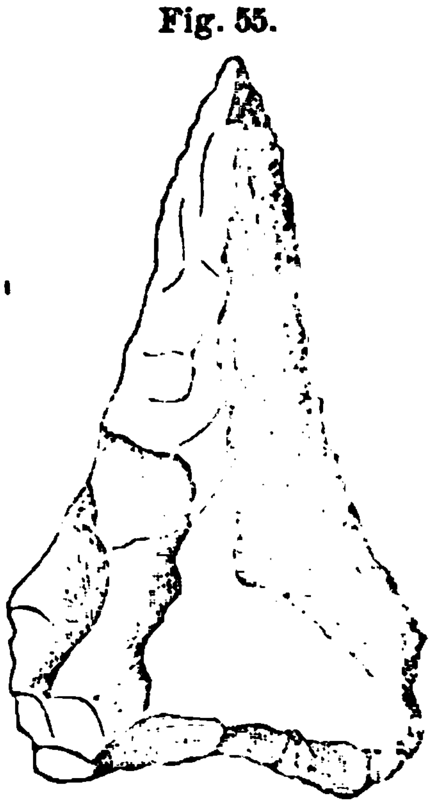
Fig. 54.



Natural size.

A handsome form is represented in Fig. 55. It has the appearance at first glance of having been barbed as in Fig. 50 but the carefully chipped sides of the base induce us to believe that it is now in its original condition. With a shaft much narrower than the base of the specimen, this would be one of the most effective arrowpoints that we have figured. It is not a common variety in this neighborhood (Trenton, N. J.) but we have met with quite a number precisely of this pattern in the collections of others. They are usually of jasper; very smoothly chipped and are thin and easily broken. The fragments of this form are much more abundant than of many others.

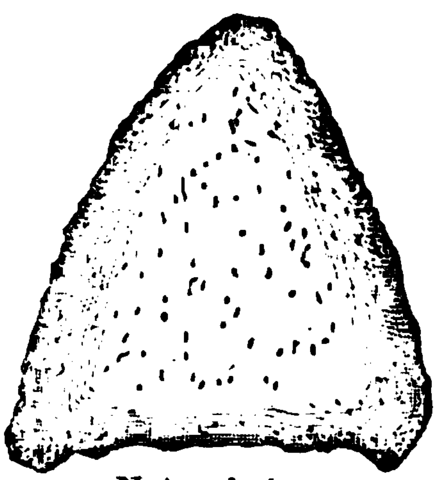
Fig. 55.



Natural size.

Straight based specimens, as given in Figs. 56, 57, 58 and 59, are very frequently picked up where arrowheads are found at all. Used wholly in bow and arrow hunting, they are scattered pretty much every where. Falling by chance, hither and thither when the hunter failed to strike the game, they have been left for anthropological entertainment until our time, to be gazed at and their workmanship admired. The most usual form of this class is the plain triangle (Fig. 56). Of white or rose quartz or of black slaty or quartzose stone, they present, in the field, so much of a contrast to surrounding pebbles, as to be readily detected and picked up. This same even edged triangle varies considerably in breadth and length, the extreme in length being the quartz arrowpoint (Fig. 57). Between these two extremes, all the variations of relative length and breadth exist. This latter figure is perhaps a little more abundant than the preceding, and when evenly cut from a piece of veined or rose quartz is a very beautiful specimen of ancient stone work. The minimum size of equilateral triangular arrowheads of this pattern is shown in Fig. 58. This specimen is cut from a piece of dark chocolate jasper. Its size is usually found cut from black stone, and is generally of equally good workmanship. Like the more slender, green jasper specimen (Fig. 52), it must have been used only in securing small birds and mammals. A rare form of this class is the pretty specimen (Fig. 59). This is cut from a piece of greenish jasper, and while very peculiarly outlined, still bears some resemblance to the specimen already described (Fig. 55). The base also approaches that of the beautiful specimen, Fig. 45. Indeed, we were at first inclined to believe that that form was intended, but the narrow

Fig. 56.

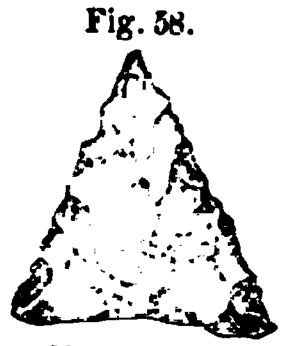


Natural size.

Fig. 57.

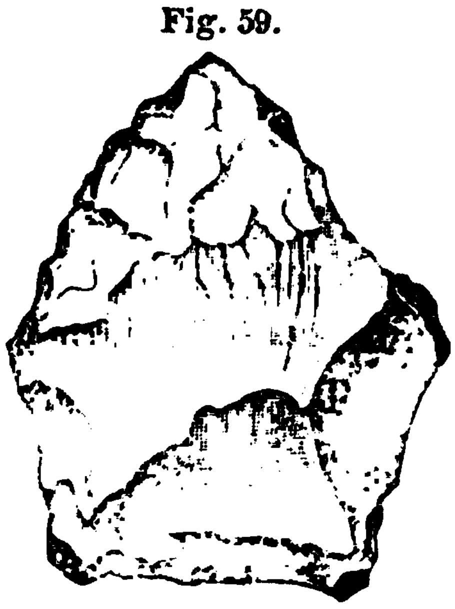
Natural size.

Fig. 58.



Natural size.

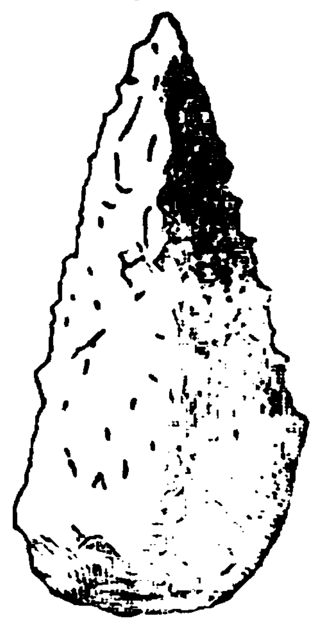
Fig. 59.



Natural size.

stem being broken, it was finished up as we now see it. Lately we have seen several stems like it, but smaller, and as they are all thinner than the stemmed arrowheads, and show nothing of the well marked central ridge that they have, we believe that this style was designed, just as it is, but probably for some especial purpose—some particular game. They are about as scarce as any one variety, so far as our experience in collecting goes.

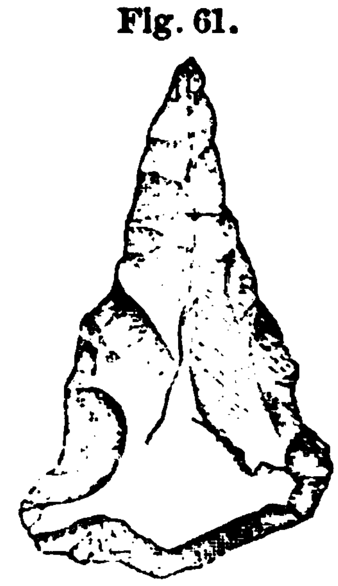
Fig. 60.



Natural size.

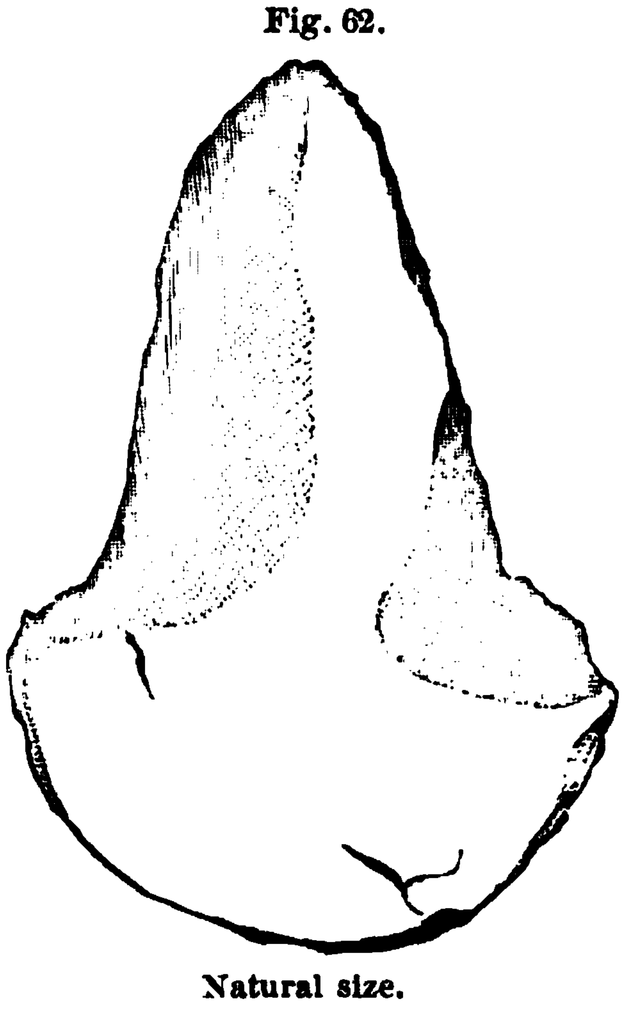
The leaf-shaped arrowhead and its modifications, and those arrowheads with convex bases, are well represented in numbers, in the usual day's "find" in any neighborhood good for collecting. The plain leaf-shaped form (Fig. 60) is the prevailing variety, and the difference in size in a large series is but very slight. They are generally chipped from white quartz, and exhibit careful workmanship. The point and edges are invariably sharp; the indestructible nature of the mineral having helped to preserve them until this time. When first lost, who can say? A variety of this form, verging into the plain triangle is shown in Fig. 61. The plainly notched base shows how it was attached to a shaft, which does not appear so readily in the case of the preceding form. The present form is but seldom met with. So far they have varied but very little in size or material (jasper) from the one figured. Another and peculiar form is shown in Fig. 62. This specimen is of mottled slate, and is larger than the general run of leaf-shaped arrow heads, even of that given in Fig. 60. Its size indeed suggests the spear, and we are somewhat inclined to think that an arrow with such a head would be a very uncertain weapon, in the hands of howsoever good a marksman.

Fig. 61.



Natural size.

Fig. 62.



Natural size.

In continuing the subject of arrowheads, we have a few words to say concerning certain forms that have more or less affinity to those already figured, but have peculiarities of their own, worthy of some special comment. The first of these specimens is illustrated by figures 63 and 64. While bearing some resemblance to each other, they are not both fragments, as they appear; Figure 63 being evidently a finished specimen, as the base is chipped and not broken. This fact renders it probable that the other (Fig. 64) has had a chipped base of similar form, which has since been broken. Both have had, and one still has, a very good point. They are thick and heavy; strong enough for harpooning, but are not long enough to penetrate sufficiently deeply to kill, say a sturgeon or gar. When these were in use, our pickerel

Fig. 63.

Natural size.

Fig. 64.

Natural size.

may have been much larger than now, and in that case they would have been effective in spearing them, but are too cumbrous for the slender Esoces that are now found in our waters. In works on prehistoric remains, we do not find this form figured or described in either stone, bone, or bronze. Unless one or two fragments that we have belong to this form, we have never met with any other specimens than the two here figured. The specimen given in Fig. 63 is of jasper and heavier in all its details than the other which is of lighter material and more smoothly chipped throughout.

A third example of arrowhead exhibiting certain peculiarities is represented by Fig. 65. It has been frequently remarked that arrowheads, wherever found and of whatever age, all have very much in common; and if a collection from all quarters of the globe was to lose the labels, it would be a difficult matter to de-

termine the locality of each, unless the mineral, from which they were made, would decide the question; and another interesting feature is the similarity between arrow, spear and harpoon points of an age long past and those now being used and made by the savages who are still more or less completely in their stone age. Bearing this in mind, we call attention to the "harpoonpoint," which in all important features is identical with one figured by Prof. Nilsson,* and concerning which he says, "the stone points (for harpoons) vary in shape; sometimes they are as in pl. iii, figs. 45, 47. Such are likewise found in Scania . . . . The broad head seems to indicate that they have been harpoons rather than arrowheads. . . . . It appears to me certain that pl. x, fig. 203 has been the stone point of an harpoon. . . . A person who had long resided in Greenland recognized it at once as such." Here we see that a New Jersey and an ancient Scandinavian specimen, and a Greenland one of the present day are identical. If breadth of the head of arrowpoints is an indication of use as harpoons, then several that we have figured must be placed under that heading; but while they have unquestionably sufficient breadth, as shown in Figs. 36 and 37 and 38 and 39, they have not a notched or other style of base, that would secure a firm fastening to the staff of the implement.

Fig. 65.

Natural size.

Fig. 66.

Natural size.

Fig. 67.

Natural size.

Fig 68.

Nat. size.

In concluding the subject of "arrow heads," in this present paper, we desire to call attention to two other examples of specimens having a marked similarity to those figured by ethnologists in works de-

* Stone Age in Scandinavia, edited by Sir J. Lubbock; plate x, fig. 203; and page 28.

voted to "relics" of other countries. Prof. Nilsson, to whom we have so often referred, figures on plate xiii, figs. 225–226, two "arrowheads", which he refers to (page 88) as spears which have been worn down and broken from use, and repaired; and considers the specimens to have been once like others referred to, about six inches in length. Fig. 66, found here in New Jersey, is almost identical except in size, which is but one half that of the Scandinavian specimen. It seems not a little curious that not only do we find here pretty much all that characterizes the Scandinavian stone age, but even fragments that have been utilized are here found, showing that they, too, have undergone a similar restorative treatment.

Fig. 69.

Natural size.

Figure 67 represents a handsomely chipped, rough-edged, bluntly pointed arrowhead; at least we will here follow Prof. Nilsson, and call them so, inasmuch as he has figured the same form, except, that they appear more roughly worked. He gives two figures that show the similarity better than a mere description can, on pl. ii, fig. 36, and pl. xvi, fig. 266. In size the specimens agree.

As, most frequently, stemmed arrows of any variety are in a fragmentary condition, we call attention to the illustration of a jasper arrowpoint (Fig. 68) which is perfect in itself and quite equals, in beauty of finish, any specimen of European flint chipping we have ever seen. There were certainly some very skilled arrow makers among our aboriginal, stone age people.

Taking a general survey of the collection of arrowheads that we have now studied in detail, one or two circumstances connected with them become evident and are worthy of comment. As a class, they are usually about one-third smaller than similar arrowpoints, as described and figured by various authors, from Europe especially, and, looking at them from a mineralogical point of view, we

find that the majority are made of minerals that are not to be found anywhere in the neighborhood, or even in the state; and as they were unquestionably manufactured here, the minerals in bulk must have been transported from a distance. The large jasper hatchet (or lancehead, Fig. 22) was one of a hundred and fifty, all of which were cut from the same mass, and considering them to weigh eight ounces each, we have in them a bulk of stone not pleasant to carry as transportation was then effected—on men's backs probably. Indeed, near where these were discovered, was afterwards found a mass of the same mineral which was quite heavy but we cannot now recall the exact weight.

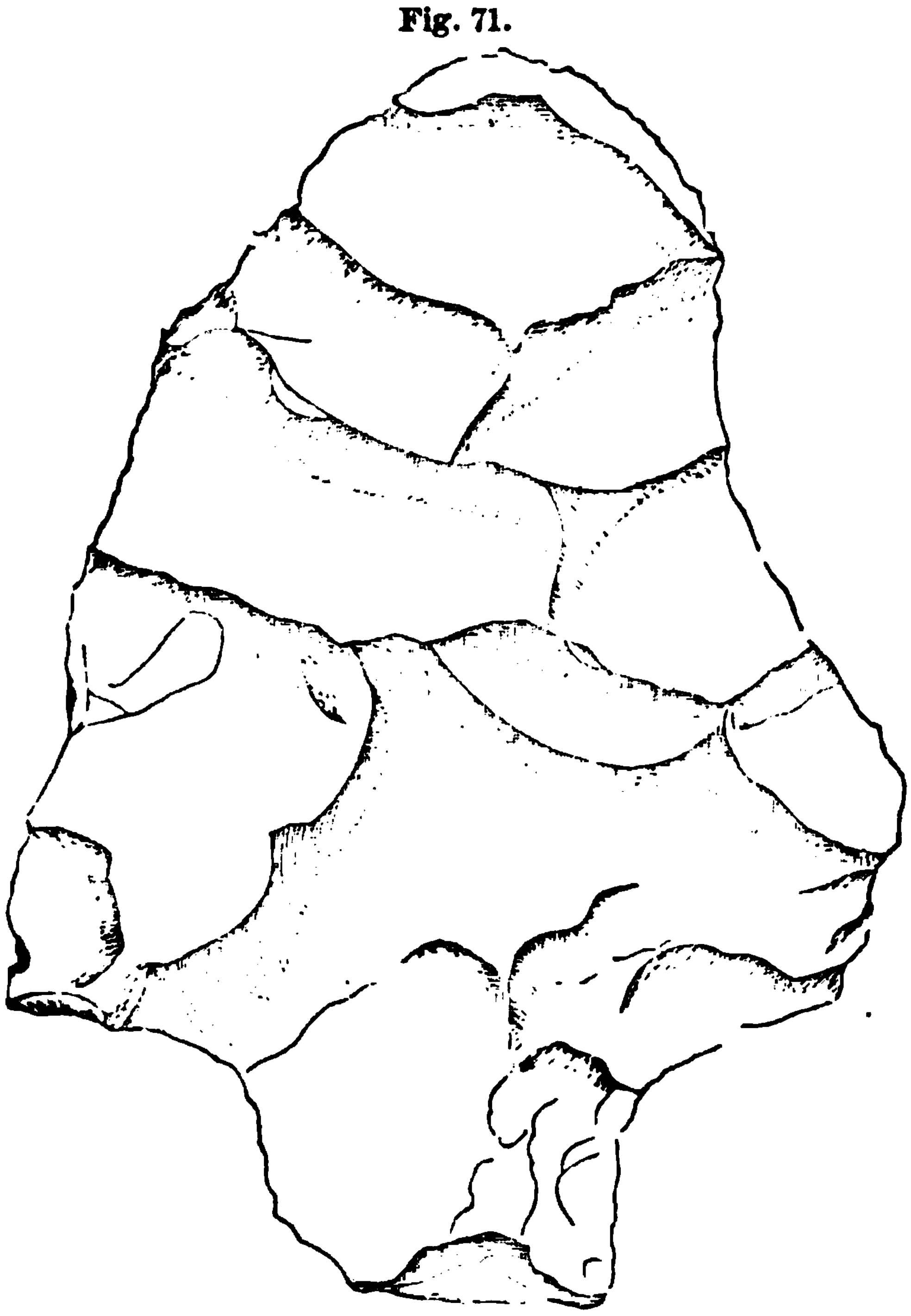
Fig. 70.

Natural size.

SPEARS. — There are to be found in almost every field, where arrowheads are ever met with, certain large specimens having all the general features of the preceding, but were unquestionably intended for other purposes. Such specimens we have designated "spears," a term which may or may not include "lances," as what we shall presently denominate a lance may really not have been so used. Fig. 69 represents a perfect specimen of the spear, it being, as are so many of the arrowheads, provided with the tang, or projecting base; and in general appearance resembles several of the forms of those smaller implements. This specimen is of jasper. Very well, but not as finely, cut are many arrowpoints; and it shows by its whole aspect to have been wrought out with a view to strength and durability, as well as being effective in the chase or in battle. The point and sides are still very sharp and capable of inflicting a fearful wound if thrust with a moderate amount of force. The specimen figured is three and three-quarters long by a little less than one-half in width. This size is about the average of the spears such as we are now describing.

Fig. 70 represents an allied yet much handsomer form, which is quite rare and so far has been always found (by us) in a fragmentary condition. It is simply an enlargement for spear purposes of a common form of arrowhead. The workmanship of this specimen excels that of the preceding, which may, however, be due to the greater tractability of the mineral. Like the other spear we have figured, this specimen as a hunting implement or weapon in war is very formidable. With the ordinary force of a man's arm, such a spearhead would impale a sturgeon, and thrown as a javelin would probably cleave a man's skull. The sharply barbed base would make this more efficacious in the chase than some of the European specimens figured by Prof. Nilsson, which, however, are usually somewhat larger. Sir John Lubbock figures a modern Esquimaux spearhead in "Prehistoric Times," fig. 218, which is very innocent looking in comparison with this.

Fig. 71.

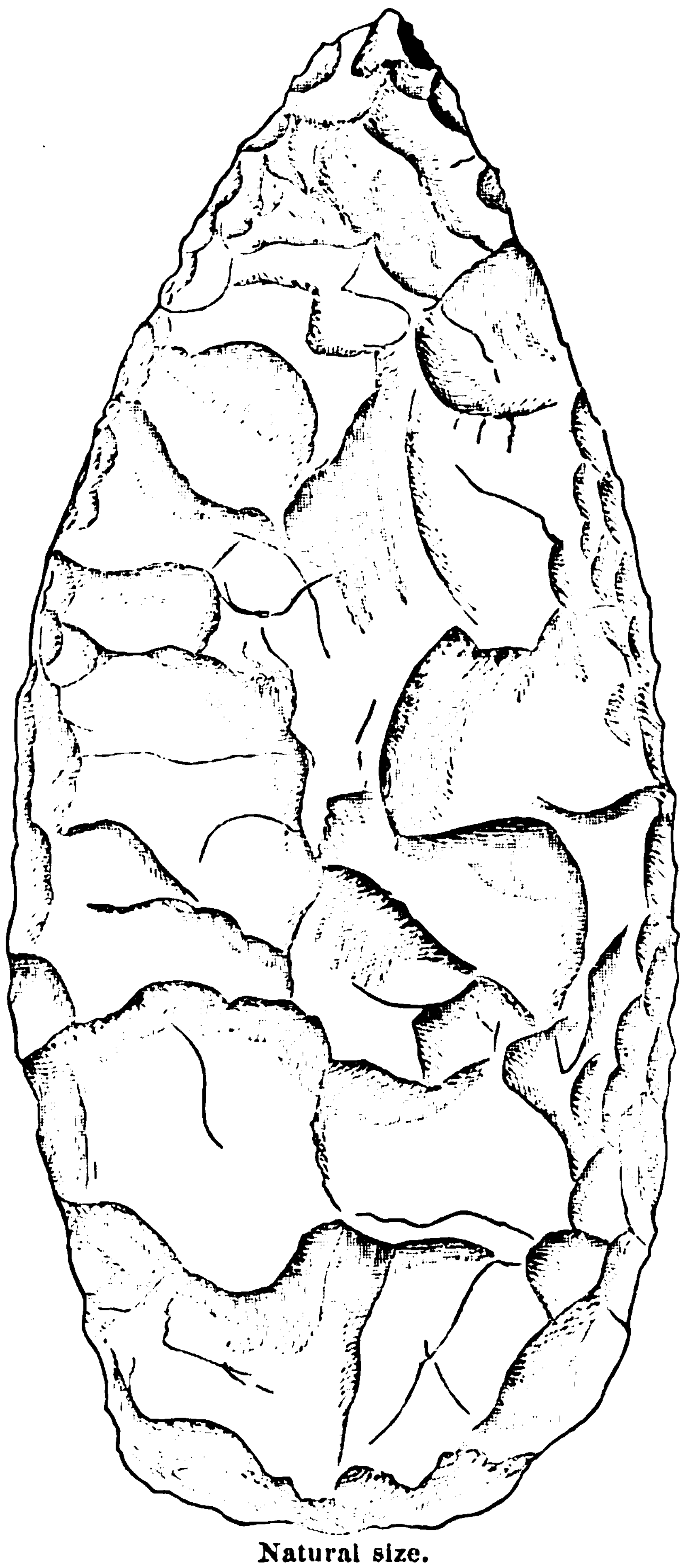


Natural size.

Judging from the abundance of stone implements that are made of a much less durable and easily wrought material than jasper, it would seem as though there was an ancient aristocracy, or at least, then, as now, there were two classes, a more wealthy, and a poorer one. Fig. 71 represents a very common, although invariably (so far) broken style of spearhead, differing somewhat from the preceding (Fig. 70), but closely allied, however, to it. This specimen is broader and has been longer. The base is merely a straight, narrow tang and suggests

the base of the preceding, which we have represented as similar to this. The two specimens each supply to the other the missing parts, or at least suggest them. These three allied forms of true spears are not abundant. Probably they constitute about one per cent. of the "find" in any locality, except, perhaps, the sites of the former labors of arrow makers. Here fragments of spears abound in greater proportion. Their use rendered them more likely to become broken than arrowheads would be; and we now find that a much greater proportion of them are broken, notwithstanding their much greater strength. Possibly their size, rendering them more conspicuous, has led to their having been more frequently gathered up, years ago, when their shape and beauty made them attractive and curious, before they were considered of scientific value. We know of three beautiful specimens of large jasper spears that were picked up by the grandfather of their present owner over one hundred years ago. Indeed, if we had now in our possession one-half of the specimens we gathered and lost, when rambling about the country during summer vacations, the illustrations of this paper would be far more attractive.

Fig. 72.

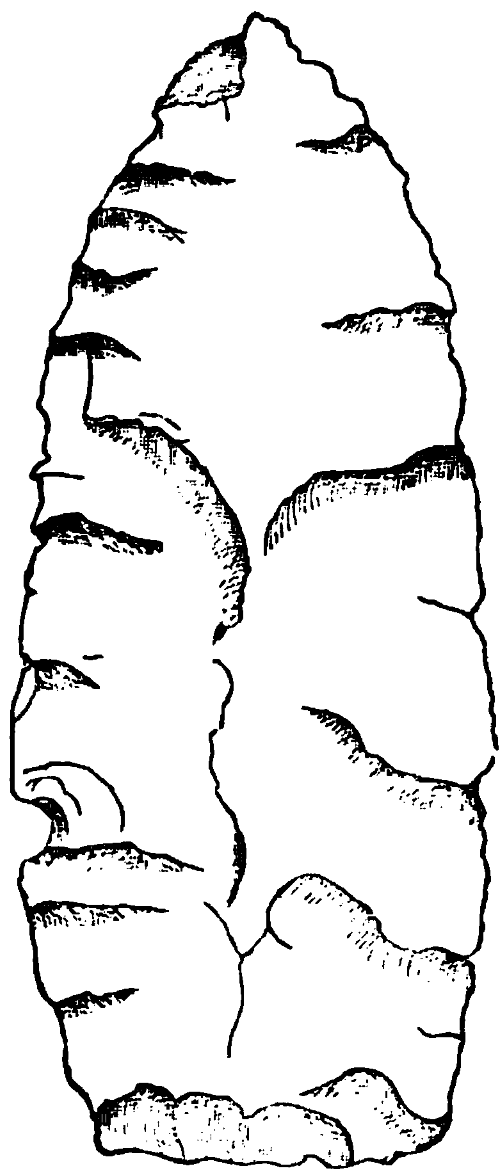


Natural size.

As we separated the arrowheads into two classes, those with projecting bases and those not so furnished, so we must also sepa-

rate the spears. Fig. 72 is a beautiful specimen of a spearhead of a kind of flint, and mineralogically is unlike any other specimen in our collection. It is the leaf-form of arrowhead enlarged and is of fine workmanship. As a weapon it must have been valuable, but it is difficult to conceive how it could have been sufficiently securely attached to a long shaft. It is little less than five inches in length, by two and one-eighth in breadth. We have never met with another specimen that was like it in all particulars, size included, but have seen them in collections made elsewhere in the United States and in South America.

Fig. 73.

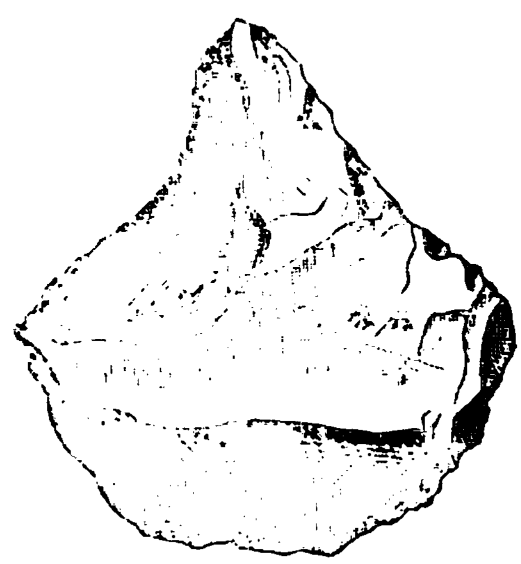


1-4 natural size.

LANCEHEADS.—Fig. 73 is a representative of an average specimen of those long, slender, finely edged slates, which we here denominate as "lanceheads." They are never wrought with that care which characterizes arrow and spearheads, but still have had sufficient care bestowed upon them to show that they were for some important purpose. They are very abundant, scattered promiscuously over the whole state, and turn up at odd times, every where and anywhere. Along the shores of our creeks and from the bottom of the Delaware River, upland and lowland, it seems to make no difference as to the character of the place, here or there, they are equally abundant. We cannot now remember how many specimens of them we included in a collection sent in the summer to London, but we believe that they, with the pile now before us, would number nearly a hundred. We have intimated that they were only of slate—this is not so. The "deposit" of which we have spoken already, of jasper specimens, of which the large hatchet figured was one, was composed of "lanceheads" very similar to this slate here figured. As all these "slate" specimens have a well defined, blunt base, we have thought that the handle or shaft must have been here attached, and if so, then we cannot look upon them as anything else than lances or javelins. The *majority* of "the jasper deposit" just referred to also had this same feature of a well defined base.

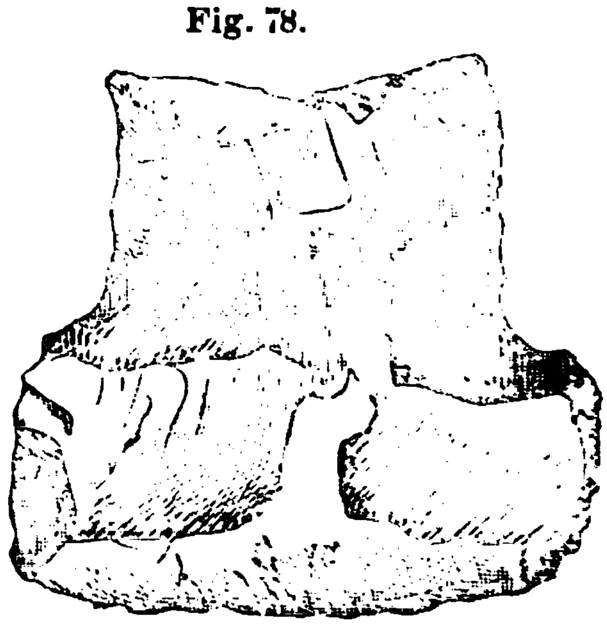
rope seems to have always a large number of rude implements that have been called "scrapers:" viz., tools for scraping and cleaning raw skins of animals, which were afterwards to be converted into clothing. Prof. Nilsson, besides these "scrapers," describes a "stretching implement," which may or may not be represented here by certain carefully cut jasper specimens, which we will refer to presently. Specimens that we here figure as scrapers (Figs. 76 and 77) approach somewhat to the figures and descriptions of Nilsson and Lubbock, but do not agree wholly with either. Fig. 76 will be found somewhat similar to the illustration in Nilsson's work, plate ix, fig. 188. It will be noticed, however, as in all our New Jersey specimens, that both sides are chipped. Specimens such as this and those following were sent to Sir J. Lubbock, who expresses surprise at the absence (in the collection) of "true"

Fig. 77.



Natural size.

Fig. 78.



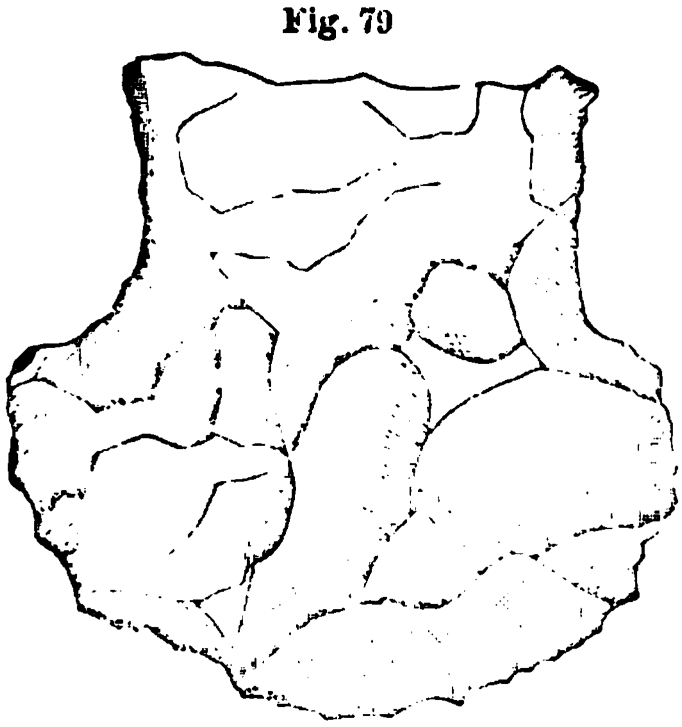
Natural size.

scrapers. Admitting the dissimilarity between the European and the American specimens, we still claim for ours greater beauty of finish and fully as great adaptation to the use intended.

"Stretching Implements."—Prof. Nilsson calls by this name certain forms of stone implements, which he says resemble greatly "the bone implement, provided with a handle, which is there used for stretching the skins in order to give them the requisite softness." The figure that he gives is represented with a *sharp* edge, but he says, in the body of the work, that "the widened part, representing the edge, has been *rounded* off by *constant wear*, probably from being rubbed against leather or something of that kind." ("Stone Age in Scandinavia," p. 77.) The widened part of our specimens (Figs. 78 and 79) are not worn smooth in one sense but the ridges are not acute enough to endanger the leather by

cutting, and we can readily see that, provided with a handle, they would be well adapted to the use he mentions with refe ence to Scandinavian specimens. One argument in favor of these specimens being used for domestic purposes, is that we have found them numerous in certain localities, where the large number of fragments of pottery, "corncrushers," pestles, etc., shows that on that spot once was a dwelling or village of those ancient people who utilized the "relics" that we have been describing. As to their manufacture, we have but to remark that they appear to have been made from the mineral directly, and not from the bases of broken spearheads, our reason being that they are generally thicker and wider than spearheads; though, on reference to the spearhead (Fig. 69), it will be seen that the basal third of this specimen would make a "stretcher" very similar to the one we have figured here, 79. These stretchers or skin dressers are quite abundant. From one field of but eight or ten acres we have over seventy specimens, all agreeing remarkably in size and shape, and, with one exception, all are cut from jasper.

Fig. 79

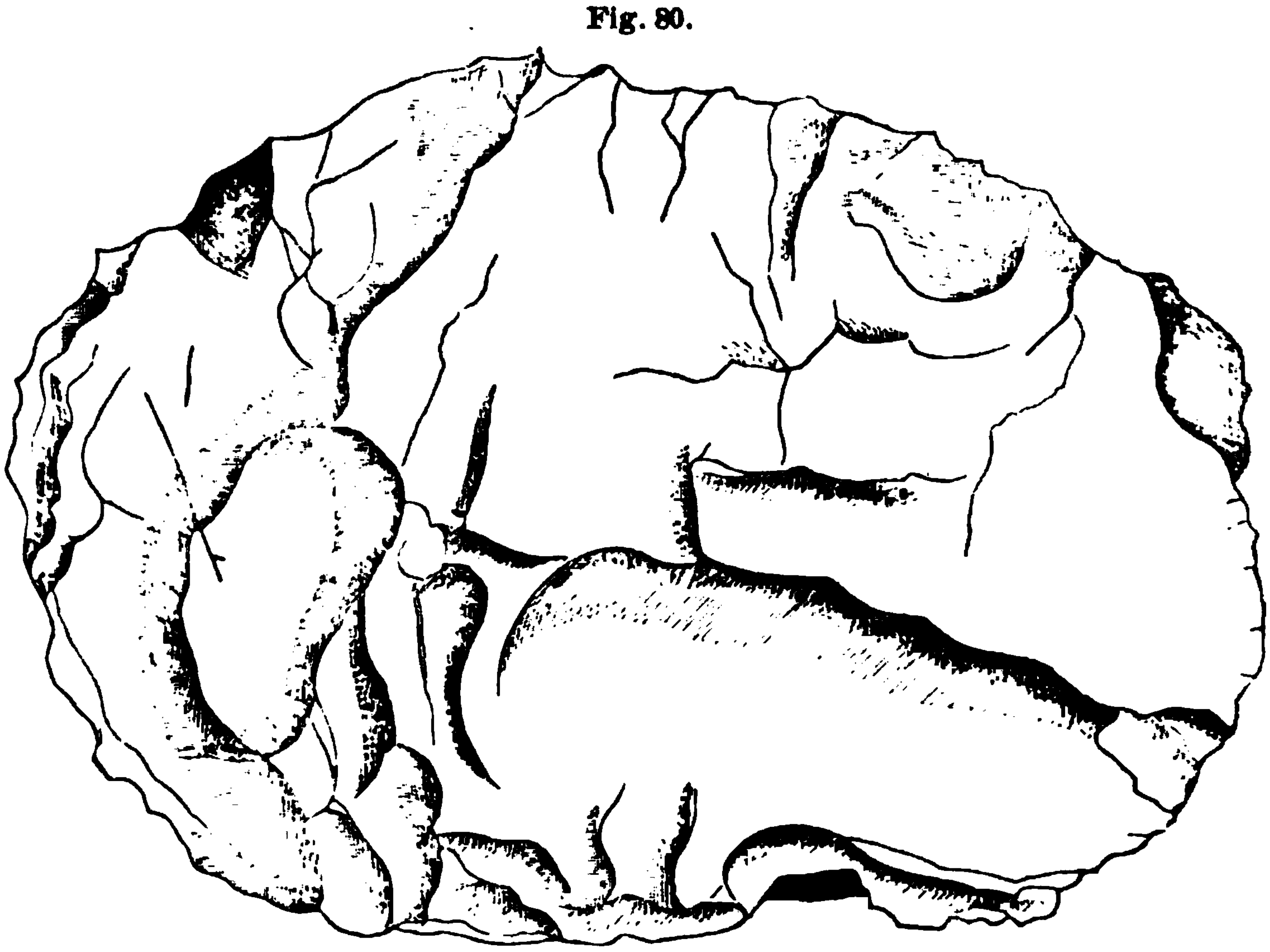


Natural size.

Somewhat allied to scrapers, hatchets; and in a measure *sui generis*, is the next illustration we shall give. The specimen itself is a light yellow jasper "flake," subsequently chipped about its edges. If a "hatchet" handle were attached to the centre of the flatter side, or base, the stone would then make a comparatively good double edged axe or hatchet. If, however, a short bone handle had covered the straight side or base, then the specimen could have been used as a knife, or "skinner," although now its edge is too irregular and dull for skinning. When sharper, however, it could have been utilized in detaching the tough hide of the bison or a deer; but whether or not the bison ever roamed in New Jersey, we know not. Lubbock figures as "flint implements," a series of specimens taken from a tumulus at West Kennet, Eng., (Prehistoric Times, p. 153, figs. 147 – 50;) and to his figure 150 our specimen certainly bears great resemblance. As Sir John Lubbock

does not give any other name to the specimens, nor suggest their probable particular use; we can only follow his example, as to figure 80, and call it an "implement." This certainly is an easy, but scarcely satisfactory way of escaping a trouble, which perhaps is little bettered by the suggestion that just such a chipped flint may not, by its original owner, have been specially set apart for particular use or uses, but have been a sort of "handy come-by," valuable to crush a mussel, or crack a marrow bone, but never designated by its first possessor, as either the one or the other. Indeed, would not a people whose advancement was but thus far

Fig. 80.



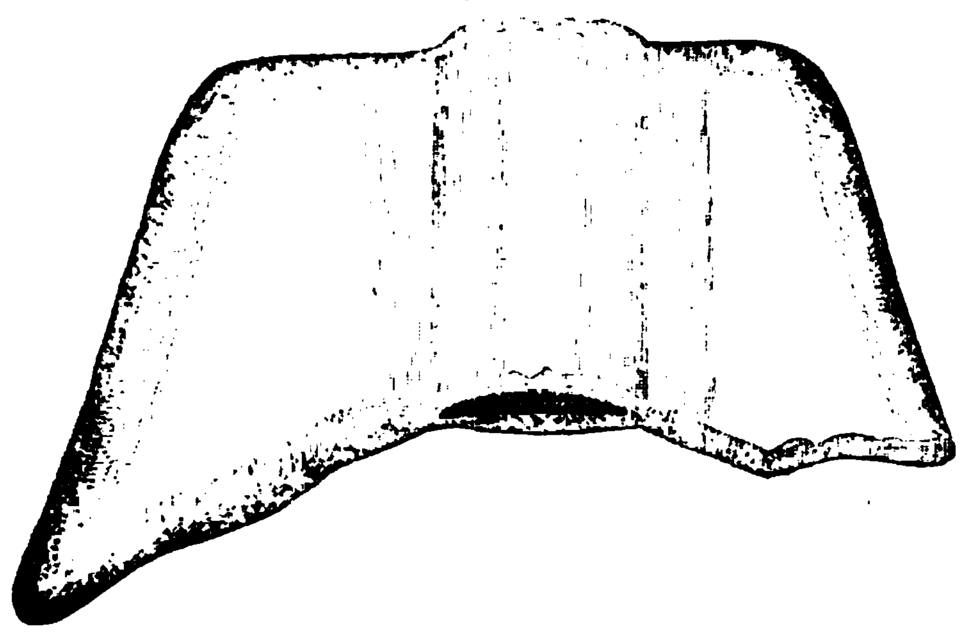
Natural size.

progressed—a stone-age people—be limited in the variety of implements, and adepts in the art of multiplying uses for a single simple article?

PERFORATED STONES.—In the fourth volume of the AMERICAN NATURALIST, page 380, we have described and figured a curiously formed "relic" found near Trenton. We now know that they are frequently found in the west, and since the publication of the notice of our Jersey specimen, a figure of an allied carved stone, from Vermont, has been published on page 16, of the fifth volume (1871). Figs. 81, 81 *a*, is an ornament or "gorget" (Squier and Davis) found in the same field with the specimen we have

referred to (Amer. Nat. page 380, 1870). It is of softer material and perhaps not as finely finished as some similar specimens; but the hole that runs the whole length of the specimen is as perfect as any drilling in metal that we have ever seen. The width of the specimen in the centre is just one inch. The breadth at the top one and one-half inches. As in the specimen figured

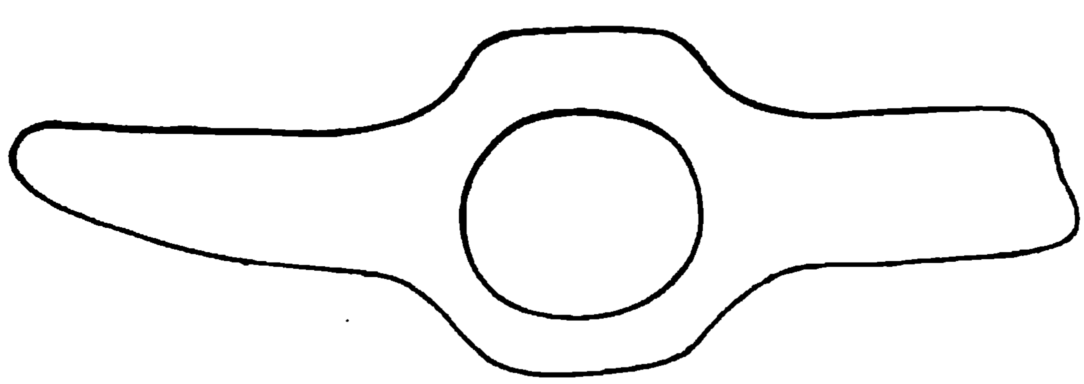
Fig. 81.



Natural size.

in the NATURALIST for March, 1871, p. 15, this has, also, the perforation slightly smaller at the apex than at the base. Another perforated stone is the elongated, quadrangular flat stone (Fig. 82). This specimen has been carefully polished and is very graceful in outline. The perforation near one end — the smaller — is evenly drilled from each side to the centre, where the two depressions

Fig. 81 *a*.



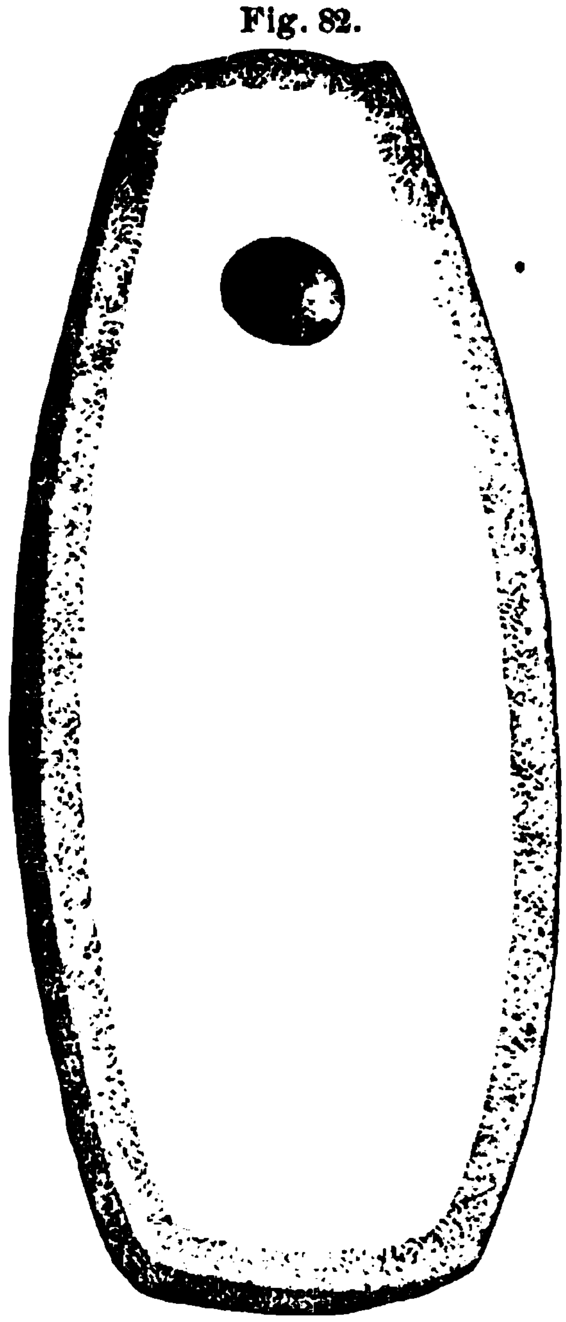
Section.

meet in an opening one-third the diameter of the drilling at the surface. The use is perhaps a matter of doubt, but the perforation suggests that it was suspended by a cord, probably around the nec:. It has been suggested that it was used as an "ear drop."

FISHING-PLUMMETS. — Girdled, globular or oval pebbles, which have been designated "fishing-plummets," are very abundant. We

have never met with any having more than the one groove each, as Prof. Nilsson describes. Indeed, one of his specimens he mentions as coming from the Delaware River, Pennsylvania; and as ours (Fig. 83) was picked up from the shore of that river, *they may have belonged to the same net!* While the fact of the vast majority of these stones being found in the beds of rivers or on the immediate shores would naturally suggest the use now attributed to them, still very many are found upland far from any water at present; so that they may have had some other use than net weights, or have been lost in the transportation of nets overland.

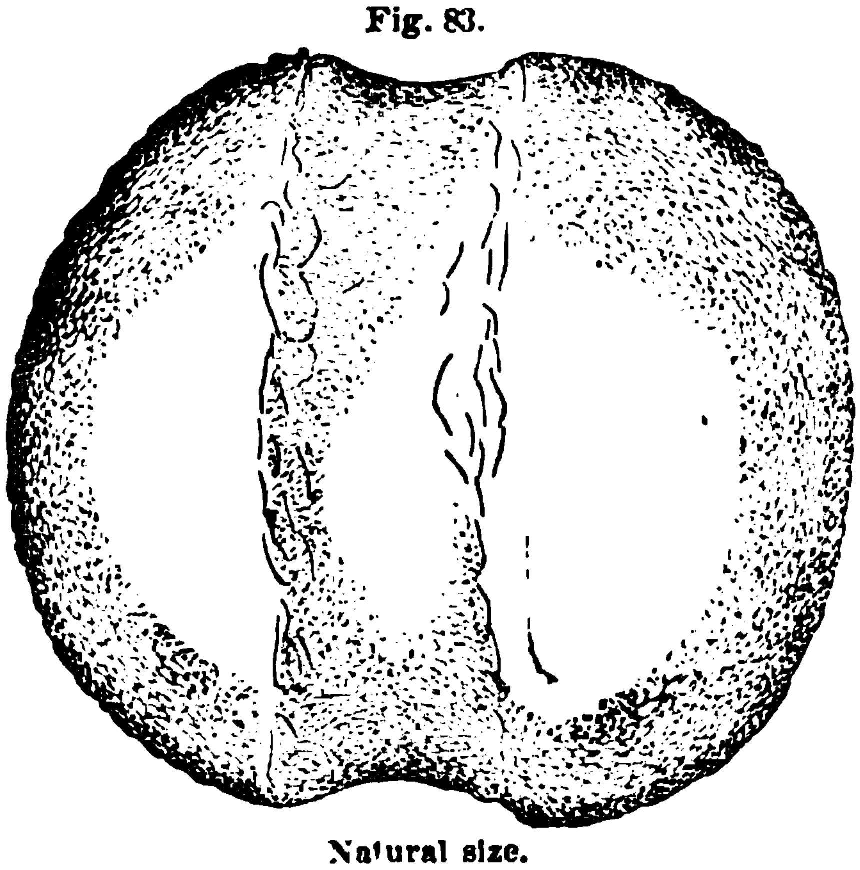
Fig. 82.



Natural size.

POTTERY. — As we have nothing but fragments to offer, we will close our extended notice of "Indian antiquities" with a few words concerning these specimens (Figs. 84, 85, 86, 87). In the style of decoration, these will be seen to vary. On examining a vast quantity of such fragments, we find no other forms of ornamentation, but frequently a combination of two, three or all of these forms. Fig. 84 is part of the top of an urn or vase, and the rim, as distinct from the sides of the vessel, is well shown. On comparison with fragments figured by Sir John Lubbock, in "Prehistoric Times" (page 154, figs. 151–4), we find that the New Jersey specimens are not greatly dissimilar and are quite as handsome.

Fig. 83.

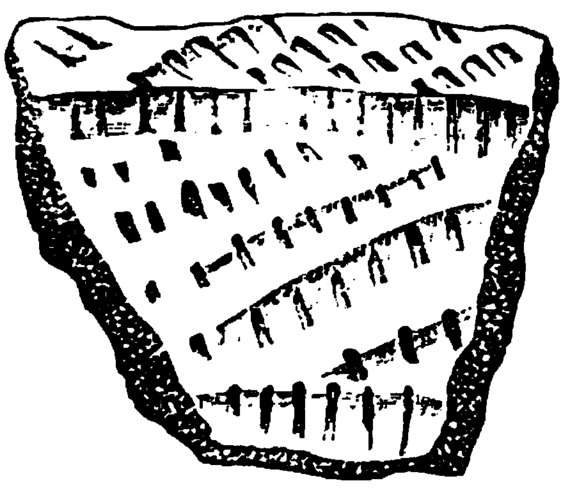


Natural size.

To what extent the "aborigines" were vegetarians, or were adepts in gastronomic science,

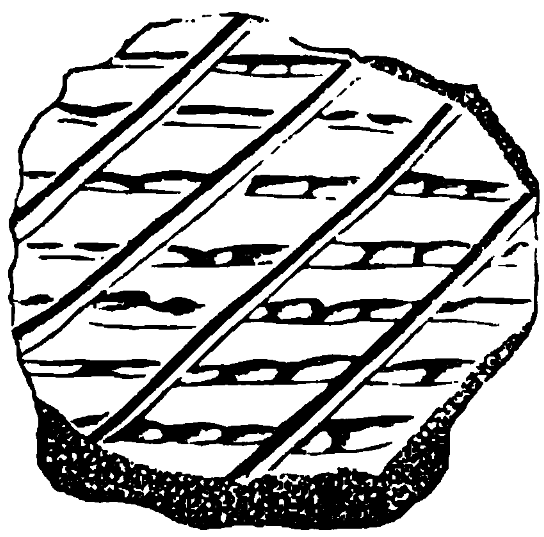
it is difficult now to determine; but besides the vast quantity of fragments of pottery, there are frequently to be found, long, cylindrical stones, with tapered and polished ends, that for want of a better name, perhaps, are entitled "pestles." They are too well known to need a figure given of any specimen, and their whole extent of variation is in length and diameter. The largest

Fig. 84.



Natural size.

Fig. 85.



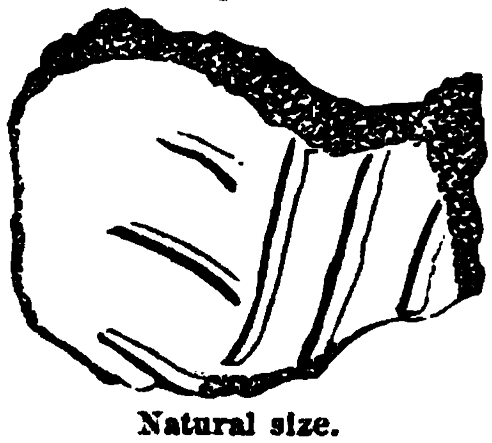
Natural size.

we have ever seen is in the possession of Dr. John W. Ward of Trenton, and was found near that place. It is seventeen and one-half inches in length, and scant eight inches in circumference. It is bevelled at either end and polished; indicating that the ends were used in crushing corn (?) by striking blows, rather than by rolling the pestle in the depression of a basin-shaped stone. Very many of these pestles are less uniform in their circumferences, being nearer an ovoid cylinder in shape than truly cylindrical, and again, some specimens we have gathered, have a somewhat polished surface at the middle, showing that the usual contact was there, rather than at the ends.

Fig. 86.

Natural size.

Fig. 87.



Natural size.

Very many of these "pestles" are of diminutive size, varying from three to seven inches, and of diameter in proportion. Their use is plainly indicated by the occas onal presence of a shallow mortar; a circular flat stone, in the centre of which is a depression that has been gradually worn by the constant rubbing action

of the little pestle. Their use was unquestionably to prepare the paint used in the decoration of the face and body. Indeed, one specimen of such mortar and pestle, exhumed with a skeleton and some weapons, had a hard cake of reddish clay filling up the depression of the mortar, which was the more easily recognizable, as the surrounding earth was of a peculiar blue-black color, being an admixture of the surface loam and underlying blue triassic clay that is so abundant in the neighborhood of Trenton, New Jersey.

Of other implements belonging to our prehistoric kitchens, there is but little to be said, except of certain large, saddle-shaped stones that are claimed to have been used as the "mills" whereat, by the use of large pestles, maize was crushed before being used as food. Certainly several such stones as we refer to were admirably adapted for just such use; and we doubt not that to consider them as corn-mills is correct. They have invariably been too unwieldy to move from the fields for purposes of illustration; and in fact have varied so in shape, that no one illustration would give a general idea of the whole set.

The same remarks will apply to other large stones, that appear to have been utilized by the Redman, and are called "anvils," for want of a more correct designation. Dr. Thomas S. Stevens of Trenton, to whom we are indebted for many favors, has called our attention to one such anvil, which was found on the site of an "Indian" village. The stone in question is about twenty inches in height; has an hour-glass contraction at the middle, and has a level, circular surface at either end of about nine inches in diameter. Where contracted at the middle, it measures about five or six inches in diameter. The present shape of the stone, we found on trial to be admirably adapted for use as an anvil, or "bench;" by placing it before you, between the legs, and seating yourself upon the ground. Thus positioned, one could easily imagine himself a prehistoric arrow maker, resting one surface of a block of jasper upon the upper face of the anvil, and striking off the precious flakes, that a subsequent laborious chipping would transform to such delicate arrowheads as we have figured. Whether such an anvil as here described, was shaped from a globular boulder or not, is a very difficult question to decide; but judging from the mineralogical character of the implement, we consider that it originally had some resemblance to its present shape, and was afterwards chipped to perfect the uniformity of its hour-glass contraction.

We have now described typical specimens of our collection. It must be borne in mind, that they are all from one limited locality, except one axe, and that collectors may now have or may discover within state limits much that we have not seen. We may add to our own collection as the years roll by; but notwithstanding all this, we believe that the ground has been sufficiently gone over to warrant us in heading our article, the Stone Age in New Jersey.

NOTE.—Since the original manuscript of this article was written I have had an opportunity of seeing "Hæckwelder's Narrative;" and this missionary there states, that the New Jersey bank of the Delaware River, from Trenton to Bordentown, was occupied by a "great king" to whom the many lesser chiefs were subservient. This fact may explain why this locality is so singularly rich and varied in its forms of antiquities. May not the surrounding tribes have brought hither, as tribute, tithes of their choicest weapons, and thus explain why so many specimens of weapons of foreign minerals are gathered in the fields, which possess *naturally* none of the minerals of which so many of these implements, are made? As Hæckwelder was one of the earliest Europeans visiting these parts, his account is well worth referring to, whether our assumption be correct or not. It is interesting to know that the locality of which we have treated, was once a place of importance to the people whose scattered *relics* alone are left for us to study them by.

REVIEWS AND BOOK NOTICES.

SIEBOLD'S PARTHENOGENESIS.* Professor Von Siebold, well known by his first work on the Parthenogenesis of the bees and silk worm (*Bombyx mori*) gives here further statements of a similar development in *Polistes*, *Vespa holsatica*, *Nematus ventricosus*, *Psyche helix*, *Solenobia triquetrella* and *lichenella*, *Apus cancriformis* and *productus*, *Artemia salina* and *Limnardia Hermanni*. The facts reported are the results of observations, continued through a dozen or more years. The manner of observation, and the statement of the facts are equally interesting and important. They form a masterpiece and indeed a standard for every zoologist desirous of knowing how to observe and how to study. There are twenty-one observations concerning Apus reported from the years 1857 to 1869 at four different localities, in Bohemia, Croatia, Poland and Italy. The number of collected and investigated specimens for each observation varying between 21, 100, 500, 1000 and even 5796! Males were found only in Krakau, Breslau and Croatia. In Bavaria, near Gossberg, Siebold did not

* Beiträge zur Parthenogenesis der Anthropods von. C Th. E. v. Siebold. Leipzig. 1871. pp. 238, pl. 2.

find any males in ten observations in the same place in the years 1857 and 1869, although nearly 10,000 specimens were carefully investigated. The chapter on Polistes is really a masterpiece. In the concluding remarks is stated the law that in Hymenoptera (Apidæ, Vespidæ, Tenthredinidæ) the parthenogenesis development always results in males, while in Lepidoptera and Crustacea (Psychidæ, Talæporidæ, Phyllopoda) always females. The first, the Parthenogenesis resulting in males, is called Arrenotoxy by Leuckart; the second resulting in females is called Thelytoxy by Siebold. There are some observations recorded on an initial development without impregnation of the egg in vertebrate animals, by Oellacher on the hen, by Hensen on the rabbit, by L. Agassiz on codfishes. Finally, the fact that no male of the eel has been found is shaken; a fact which suggests that they are produced by parthenogenesis.—H. HAGEN.

ETHNOGRAPHY OF THE SHORES OF BEHRING SEA.*—This well known author having visited Behring Sea nearly forty years ago, has now collected all the ethnographical facts of those parts, as its people are rapidly becoming extinguished and their customs are dying out. The chapters are: concerning the Aleuts; concerning Koljusches; the names of the people along the northern American and Asiatic shores; voyage from Kamtschatka to Sitka; reception in Sitka; the Koljusches in Sitka; the religion and legends of the Koljusches; liberty and slavery of the Koljusches; their exterior appearance; their industry together with that of the neighboring people, their dress and the material of it, their shipbuilding, the metallurgy, their food and vessels for preparing it; the Aleuts, their physical constitution, sexual customs, dwellings, shipbuilding and navigation, weapons of the chase and hunting, anatomy and medicines, sense of beauty and æsthetical enjoyments, legends and songs, numbers in the language and words for numbering of all people around the Behring sea. Finally, there is a chapter on the history of the instruments used for making fire by primitive people.— H. HAGEN.

EARLY STAGES OF DRAGON FLIES.†—The dragon flies are said to

* Ethnographical observations and experiences on the shores of the Behring Sea by Prof. A. Erman in the Zeitschrift für Ethnology, 1870 and 1871. p. 295–326 p. 369-393. p. 149-175 p. 205-219 with a map.

† Illustrated Catalogue of the Museum of Comparative Zoology. No. V. The Immature State of the Odonata. Part I.—Subfamily Gomphina. By Louis Cabot. Large 8vo. pp. 18. Three lithographic plates. Cambridge. 1872.

be difficult to raise from the larva state, but the difficulty can be overcome, and we hope that this paper with the beautiful plates containing figures of so many forms, may excite students in entomology to rear our dragon flies in aquaria. It is this kind of work that tells in advancing science, and a work to which the labors of systematists are largely preparatory. Those who live away from libraries and museums can easily devote themselves to observing the habits and early stages of insects, and thus do as much, or even more, to advance entomology than they who give their time to describing new species. Mr. Cabot describes the immature stages (larva and pupa) of seventeen species of which four were raised and identified beyond any doubt. Dr. Hagen holds himself responsible for the determination of the species and gives a synopsis at the end taken from Mr. Cabot's description.

THE LENS.*—In spite of the fire the first number of this new scientific journal has been reprinted and issued with commendable promptness. Among the original articles is a conspectus of the "Families and Genera of the Diatomaceæ," by Prof. H. L. Smith, which will prove very useful to students; while botanists will be interested in the list of plants about Chicago, by H. H. Babcock. Dr. J. J. Woodward describes a new method of photographing histological preparations by sunlight. Dr. Danforth contributes a useful article on the preparation and preservation of sections of soft tissues, and the editor gives us a list of the Diatoms of Lake Michigan with a description of a new Rhizosolenia (*R. eriensis*). The selected articles and miscellany are timely, and the whole appearance of the magazine very pleasing.

BOTANY.

DISPERSION OF SEEDS BY THE WIND. — A Kerner, director of the Botanic Garden at Innsbruck in the Tyrol, has contributed a very interesting paper on this subject to the "Zeitschrift des Deutschen Alpen-vereins." In order to ascertain the extent to which seeds are carried by currents of air, the writer made a careful investigation of the flora of the glacier-moraines, and of

* A Quarterly Journal of Microscopy and the allied Natural Sciences: with the Transactions of the State Microscopical Society of Illinois. Edited by S. A. Briggs, Chicago. No. 1, 8vo. pp. 64. 1871. With a lithographic plate and wood cuts.

the seeds found on the surface of the glaciers themselves, believing that these must indicate accurately the species whose seeds are dispersed by the agency of the wind. Of the former description he was able to identify, on five different moraines, one hundred and twenty-four species of plants, and a careful examination of the substances gathered from the surface of the glacier showed seeds belonging to thirty-six species which could be recognized with certainty. The two lists agreed entirely in general character, and to a considerable extent, also specifically; belonging, with scarcely an exception, to plants found on the declivities and in the mountain valleys in the immediate vicinity of the glacier; scarcely in a single instance even to inhabitants of the more southern Alps. M. Kerner's conclusion is that the distance to which seeds can be carried by the wind, even when provided with special apparatus for floating in the air, has generally been greatly over-estimated; and this is very much in accordance with the view advanced by Mr. Bentham in his Anniversary Address to the Linnæan Society of London, in 1869. Along with the seeds M. Kerner found, on the surface of the glacier, more or less perfect remains of a number of insects belonging to the orders Lepidoptera, Hymenoptera, Diptera and Coleoptera, which, like the seeds, belonged almost exclusively to species abounding in the immediate neighborhood of the glaciers.

The species of plants which are specially inhabitants of the higher mountain regions M. Kerner divides into two classes. In the first the seed or fruit is provided with an appendage of various kinds, to enable it to be carried easily by the wind; the species possess generally a short span of life, are continually shifting their habitat, will grow where there is scarcely any soil, and especially love to establish themselves in the clefts or on the inaccessible sides of rocks; their floating apparatus appears designed rather to enable them to reach these habitats, where no other plants could establish themselves, than to be carried any great distance by the wind. The second kind are much more stationary, have a greater length of life, require a richer soil, are unprovided with any apparatus for flight, and can advance only very gradually; they are consequently much less abundant than the first kind. From the above observations, and the fact of the existence of detached localities for some of the mountain species in the Tyrolese Alps, very remote from their more abundant habitats further south, M. Kerner

draws the conclusion that at a period subsequent to the glacial epoch a warmer climate than the present overspread that part of Europe, when the species referred to extended over a wide area, of which the present isolated localities are the remains.—A. W. B.

Mimicry in Plants.—In the January number of the London "Popular Science Review" Mr. A. W. Bennett brings forward some remarkable illustrations of this singular class of phenomena, which he divides under two heads:—those relating to the whole habit and mode of growth, and those which relate to the development of some particular organ or part. Of the former kind a very familiar instance occurs in the extraordinary resemblance between the succulent plants which form so prominent a feature in the flora of the sandy deserts of America and Africa, belonging to the widely dissociated genera *Cactus*, *Euphorbia* and *Hapelia*; and instances of this kind the writer thinks may generally be accounted for by similarity of external conditions. Far more difficult is it to explain the cases of "mimicry" which come under the second head, in which species growing either in the same or in different localities, imitate one another to a marvellous degree of closeness in the form and venation of the leaf, the external appearance of the seed-vessel, or in some other particular organ; and of this kind several illustrative drawings are given. It appears impossible to suggest any explanation of this curious phenomenon like that which has been brought forward in the case of similar close resemblances in the animal kingdom, viz., "protective resemblance" springing up by the operation of natural selection, and these singular facts seem to deserve closer attention than they have yet received. Mr. Bennett doubts whether natural selection is adequate to account for the growth of organisms of this description, and believes we must recur to the predarwinian doctrine of "design" in nature.—A. W. B.

Nardosmia palmata.—About four years ago my attention was called, by Prof. Albert Hopkins, to a locality in this town where the *Nardosmia palmata* Hook. is somewhat plentiful. It grows in nearly open ground; only a few large trees and some bushes being near, and in the immediate vicinity of a perennial spring of pure cold water. What are the New England localities of this rare plant?—Sanborn Tenney, *Williams College, Mass.*

ZOOLOGY.

Note of Icterus Baltimore. — The following is the spring note of the

Sometimes the first part has five notes, instead of four; and the part after the rest is sometimes sung without the preceding part. — S. S. Haldeman.

Note of Rana pipiens. — The voice of the bullfrog is the vowel of *un*, pronounced like the French nasal *un*, and repeated in groups of three notes; the last one converted into a kind of dipthong, as if by the closing of the organs over the issuing sound. Not having heard the sound for many years, I write from recollection, for which allowance must be made. Popularly, this frog is supposed to say, *Blud-an-ounz!* — S. S. Haldeman.

Disappearance of the Colorado Potato Beetle at Niles, Michigan.—In the May number of the Naturalist for 1871, I gave a brief account of the Colorado Potato Beetle, as it was observed on the farm of James Hudson during the two previous years. As these beetles have apparently disappeared from that region I have taken pains to learn something of the time of their disappearance. It appears that during the spring of 1871 these beetles were even more plentiful than during the preceding year, and that they attacked the potatoes as soon as they came up and destroyed whole fields, and went on increasing with great rapidity. About the middle of July, however, they began to diminish in number, and by the middle of August, only a few were seen, and by the first of September they had almost entirely disappeared. But the manner or cause of their disappearance is not understood. The fields of late potatoes were mostly saved. Many fields were saved by putting on "Paris green" mixed with fifteen to twenty parts of flour. It was sprinkled over the plants while the dew was on.— Sanborn Tenney, *Williams College.*

Affinities of the King-crab. — A paper on the Anatomy of the American King-crab (*Limulus polyphemus* Latr.), by Professor Owen, recently occupied two meetings of the Linnæan Society of London. The learned author entered into an elaborate description of the external structure and muscular and nervous systems of the King-crab, and of its habits and modes of life as investigated by Rev. Dr. Lockwood, of New Jersey, and Mr. W. A. Lloyd, at the Aquarium at the Crystal Palace. After a résumé of the views of its structure and affinities entertained by Woodward, Spence, Bate, Packard, Dohrn, Salter, Huxley and other carcinologists, and a reference to the analogies of the Xiphosura with the extinct Trilobites and Eurypteridæ, Professor Owen summed up in favor of retaining the Limulus as a member, though a somewhat aberrant one of the class Crustacea. Prof. Van Beneden, the eminent Belgian embryologist, on the other hand, has published a paper in the "Comptes Rendus de la Société Entomologique de Belge," in which, from a study of the embryological development of Limulus, he arrives at the following conclusions: — 1. That the Limuli are not Crustaceans, as none of the characteristic phases of the development of Crustacea can be distinguished; and that, on the other hand, their development shows the closest resemblance to that of the Scorpions and other Arachnida. 2. That the affinity between the Limuli and Trilobites cannot be doubted; and that the analogy between them is the greater in proportion as we examine them at a less advanced period of their development. 3. That the Trilobites, as well as the Eurypteridæ and Pœcilopoda must be separated from the class Crustacea, and must form, with the Arachnida, a distinct division. — A. W. B.

Respiration of Fishes. — M. Gréhant, in his lectures on respiration, recently delivered at the École Pratique de la Faculté de Medicine of Paris, mentions some interesting facts in relation to the respiration of fishes. He refers to the researches of M.M. Humboldt and Provencal, who found that a tench placed in a small quantity of water (three or four quarts) used nearly the whole of the dissolved oxygen in the course of seventeen hours, whilst a quantity of carbonic acid amounting to about four-fifths of the oxygen removed was exhaled. They found that the whole surface of the body of the tench acted like the gills in removing the oxygen, as the same amount disappeared when the animal was

only so far immersed that its head and gills were free. In one of M. Gréhant's experiments five gold fish removed the whole of the oxygen from a small quantity of water before they were asphyxiated, whilst carbonic acid was exhaled to double the amount of the oxygen absorbed. A small amount of nitrogen appears also to be exhaled. He points out the analogy that obtains between the respiration of fish and of the fœtus in the uterus. — A. W. B.

The Great Northern Shrike and the English Sparrows. — I have lately received with much interest from a pupil in Rutgers College Grammar School, a fine male specimen of the Northern Butcher-bird (*Collyrio borealis* Baird), which he had shot on the 6th inst. in a larch tree, in the city of New Brunswick. It had just made a repast on the brains of an English sparrow. Certainly it had method in its way of doing the thing. The victim was gibbeted by having its head squeezed into the crotch made by the bifurcation of two branches, each about half an inch thick. Thus suspended, the head was broken in at the top, and the brains taken out. This is not the only case that has come to my knowledge of the marauding on sparrows' brains in this place, by the northern shrike. I am of the belief that the birds of prey are waking up to the fact that the cities are affording a rich winter harvest, hence the resort thither of raptorial birds will greatly increase. It was recently said in a journal, that the owls were becoming numerous in Central Park, and were making forays on the English sparrows. Probably, if looked into, it will appear that the diurnal as well as the nocturnal birds of prey are equally on the increase in these places. Moreover, this fact I think is true of all the parks where these sparrows have become naturalized, and unless means are used to prevent, the increase of birds of prey in those parks will be very considerable, especially in the winter. The wonderfully prolific nature of these little birds will furnish rich and abundant provision, even for the Shrike, although with a singular daintiness, it selects the brains.

As to the acclimatization of the English sparrow — the bird is not quite proof against the severity of our winters. About a week ago, a flock of these birds left Jersey City for the mouth of the Bergen Tunnel, a distance of but little more than two miles, where some wheat had been spilled from a freight car. The snow had taken from them their pickings in the city. Not less than thirty

were counted dead in one place on the snow near the tunnel. The little fellows were unable to get back to their boxes in the city and so perished from the cold.— SAMUEL LOCKWOOD.

PECULIAR COLORATION IN FISHES.— A short time since while examining a number of alcoholic specimens of Cyprinoids from Ogden, Utah, collected by Mr. J. A. Allen last September for the Museum of Comparative Zoölogy, I noticed a species of *Richardsonius* distinguished by a bright vermilion spot on the abdomen. The size of the spot varied in different individuals; in some it was quite small, in others it extended from the base of the pectoral fin to the anal opening. Calling Mr. Allen's attention to this fact he informed me, greatly to my surprise, that this color was not present in the living fish when he caught them, but appeared after the fish had been in alcohol a short time. A dissection of one of these fishes showed me that the color was deposited in the areolar layer or derm. and was therefore a true pigmentary color. The only explanation I can offer to account for this peculiar appearance of color is this:—it is well known that during the breeding season fishes frequently take on the most brilliant colors, which disappear when that season is past. Is it not therefore probable that this color may have been one, at least, of the colors assumed by the fish during the reproductive period, and that the alcohol served in some way to bring out the color thus abnormally.

Whatever may have been the cause, the fact that color can so appear in fishes will serve as a caution to ichthyologists when describing species from alcoholic specimens alone, lest they confound abnormal or seasonal colors with those that are permanent.

If any of your readers have observed a similar peculiarity in any other species of fish, I should be glad to learn of it through the pages of your magazine.— RICHARD BLISS, JR.

DURATION OF LIFE OF THE DANUS ARCHIPPUS.— About the middle of last September I found my first larva (*i. e.* the first I ever happened to see though the fly is common even hereabout) and took it home to feed. I afterwards found more, having finally eight pupas, dating from 1st to 13th October, half of which I gave away; of the balance two came out males, but imperfect, the third was a female and I kept it in an empty wardian case hoping the fourth might be a male. I cannot give the date of its appearance but it was about the 18th, and at the end of a week it was

still alive and trying to suck a bit of apple paring. I then offered it some sugar and water on which it fed greedily, but the solution being too strong stuck to its feet and in struggling it lost two of them. On the 30th the last fly came out a female, and then I determined to try how long I could keep her, making my sweetened water very weak. The first mentioned died on the 15th November, and the last on the 10th December being then forty days old, and I think might have lived longer but that in the mean time I had filled up my case with plants and as she persisted in keeping near the glass her wings were continually drenched by the moisture collected on it.—LOUIS MITCHELL, *Norwich.*

AMERICAN LEECHES.—Our fresh water leeches, neglected for so long, have at length received attention from Prof. Verrill, who contributes an illustrated article on them to the "American Journal of Science" for February. About twenty-five species are enumerated, most of them being new to science, one species (*Cystobranchus viridus* Verrill) lives in both fresh and salt water. Most of our common leeches belong to Clepsine, and are found under submerged sticks, etc. and occasionally on the under side of turtles, but they seldom, if ever suck blood. They feed upon insect larvæ, small worms, etc.

GEOLOGY.

A NEW CAVE IN BERKS COUNTY, PENNSYLVANIA, was discovered sometime last November and was explored to some extent in February 1872. The above cave is now explored to the length of about five hundred feet and in width nearly three hundred feet in several apartments composed of limestone and silicious rock. The stalactites and stalagmites are of a beautiful nature, some stalactites are nearly pure silica, some twelve to fourteen inches in length and one and one-half inches in thickness, and in one apartment all quartz crystals, some purple, are as near Amethyst as can be. I intend to explore the whole and expect to find a "*bone cave* below, as the present floor, I am sure, at one time dropped down and is now from twenty to twenty-five feet in depth. I expect to find an entrance to the lower bottom. The temperature of the cave is from sixty to sixty-five degrees F. in some apartments. I think the stalactites are purer and finer than in the Mammoth Cave of Kentucky. The above cave is now

leased by Samuel Kœhler about three miles from the village of Kutztown, who intends to have ready accommodations for visitors and explorers during this April.— H. W. Hollenbush. *Reading, Pennsylvania.*

MICROSCOPY.

An Improved Mode of Observing Capillary Circulation. As I have never seen in print the following method of exhibiting the circulation of the blood in the frog, I send it hoping that it may enable some one interested in such studies to demonstrate the distribution and influence of the nerves upon the capillary vessels and circulation. I have, for over twenty years, been aware of the peculiar manipulation presently to be described; where I first obtained the knowledge, or how, I cannot state. I have made the facts known to a great many microscopists, and have not, as yet, met any one who previously knew it. If we grasp a frog in the hand and plunge it in water about as warm as can be conveniently borne, say about 120°, though I have never measured this, judging simply from the apparent warmth to the hand, we shall find that, in a few moments, the frog will become perfectly rigid; it may now be removed and laid upon a plate for dissection. Carefully opening and stretching the parts by pulling upon the fore limbs gently, or even cutting the bones if necessary, the heart may be displayed, showing the contraction and expansion beautifully; and if now the animal is placed in warm water, the lungs will immediately float out, and by a suitably contrived stage, the circulation may be examined. It is better, however, not to do this but to draw out gently the large intestine by means of blunt forceps, and then spreading the mesentery on the glass of the frog plate (I find it convenient to use a large one with an elevated glass, instead of one in the same plane, on which to spread the mesentery) we can observe the capillary circulation very nicely with a $\frac{1}{4}$ or $\frac{1}{5}$ inch objective, by dropping a bit of thin glass over the place or with a higher power "immersion." Of course the parts opened must be kept moist and covered with a cloth, and a few drops of tepid water added from time to time. If the experiment has been properly conducted, the animal will remain perfectly quiet and the circulation will continue for hours; I cannot say how long, for I have never known it to cease until long after I had finished all the exhibition I have ever had occasion to make.

If the frog is a large one, the mesentery can be spread out so as to afford the most magnificent exhibition of capillary circulation, with a distinctness, and under an amplification which will excite the greatest admiration and astonishment in any one who has only seen it hitherto in the web, or the tongue.

The objectives of a high power ought to be more tapering at the end than our American makers usually furnish them. In this respect, some of the foreign objectives are superior. It would be very little more trouble to make the higher powers at the object end but little larger than the front lens, and thus infinitely more convenient for work than with the large flat surface which most of them now present. In fact, with a $\frac{1}{8}$ or $\frac{1}{12}$ American objective, as ordinarily made, it would be impossible to approach sufficiently near to the mesentery to focus on the smaller capillaries without striking some of the larger bloodvessels. If nothing more could be done, the front set at least might be mounted in a little projecting tip or nose, and if those who are ordering objectives will insist upon this, I doubt not the opticians will do their part.—H. L. Smith.

The New Erecting Arrangement.—In the January number of this Journal, and also in the Monthly Microscopical Journal of the same date, Dr. Ward describes "A new erecting arrangement especially designed for use with Binocular Microscopes." The arrangement proposed by Dr. Ward will undoubtedly work as he proposes, but *cui bono?* It is an axiom in microscopy, as well as in other pursuits, that the simplest means of accomplishing an end is the best. Dr. Ward's arrangement is complicated and troublesome, and unless all the lenses are well made and carefully centred, definition will be injured. Dr. Ward is correct in his observation that the "*erectors usually furnished* [italics are mine] are not good and the use, otherwise satisfactory, of a good objective as an erector has not yet afforded the advantage of binocular vision." The first clause is correct because "the erectors usually furnished" reverse, counteract or destroy all the corrections which the opticians have taken so much pains to introduce into the objectives. The second clause refers to binocular vision. This has been completely accomplished by Tolles' binocular eyepiece which has been in use and before the public more than six years. Without any change from, or addition to, its regular construction or use, it gives an image *erect*, *binocular* and *stereo-*

scopic with any objective, from a four-inch to a $\frac{1}{15}$ inch; and of course it may be used for dissecting by transmitted or reflected light with any objective having "working distance" enough for manipulation — certainly with a half-inch. The only objection, if it is one, against the instrument for this use, is that the "power," the amplification, is necessarily higher than with other binoculars. But where a *very low* power is wanted I believe a pair of spectacles set with magnifying periscopic lenses will prove to be better than any binocular dissecting microscope yet devised. But the objection to the "usual erector" for monocular instruments remains. This was remedied by Tolles years ago; so long ago that he has forgotten when. He made erectors that did not disturb any of the corrections of the objective, but preserved them and gave as good effects as were obtained without an erector.

When will American microscopists learn what has been done in instruments made in their own country, by their own artists? C. S.

Note on the Above Remarks. — It can hardly be necessary to state that Tolles' binocular eye-piece, with which the writer has sometimes worked, was ignored in the paper referred to, simply because there was no occasion to mention it,— it being no novelty but an article whose properties, have been perfectly familiar to American (and foreign) microscopists for years. It is only fair to add that the new arrangement, which can be added to any microscope at a cost of two or three dollars, has been used for months by several microscopists who consider it extremely simple and convenient.

That an erector (or anything else) however perfect, can be added to the objective and ocular and give "as good" optical effects as would be obtained without the additional refracting and dispersing surfaces, is much disputed and surely cannot be considered a conceded point at the present time.

If Mr. Tolles is prepared to supply the market with erectors radically superior to those generally used, microscopists will doubtless learn the fact when it is announced, as I do not find it now, in the catalogue of the Boston Optical Works or in their advertisements in the Naturalist and other journals.— R. H. W.

Oblique Illumination.— A new contrivance, for obtaining oblique transparent illumination with high powers and black

ground illumination with medium powers, was introduced by Col. Horsley of the East Kent Natural History Society. He uses light reflected from the inside of a broad, short, silver-plated tube beneath the object. The tube may be silvered, not very permanently, by rubbing it with a solution of nitrate of silver and hyposulphite of soda. Such a tube, placed in the stage opening, would give a more oblique illumination than could easily be obtained otherwise in instruments having a thick stage.

Glycerine in Microscopy.— Dr. W. M. Ord, of St. Thomas Hospital, London, questions the safety of glycerine as a medium for studying and mounting microscopic objects. Its solvent power over carbonate of lime is well known, and he had found it ruinous to crystals of murexide, oxalate of lime, and triple phosphate. Might it not produce unsuspected molecular changes in other objects? Portions of tissue preserved unaltered in it for years, might have been affected in molecular constitution by it at the first penetration and before the first observation. More light is wanted on this subject.

Practical Histology.— Dr. Wm. Rutherford gives, in the Quarterly Journal of Microscopical Science for January 1872, a synopsis of his course of instruction in Histology. The paper is too long to reprint and too dense for abstract, but it is full of suggestions that will be useful to many others besides medical students. The author has a dashing and not unattractive manner of expressing his dissent from the opinions of most microscopists in England and this country in regard to apparatus, etc.

Variations in Size of Red Blood-corpuscles.— Manassein ("Centralblatt" No. 44, October 28th, 1871) gives the result of more than forty thousand measurements on one hundred and seventy-four different animals, intended to show the effect of various physiological and morbid influences on the size of the red corpuscles. In general, influences which raise the temperature of the body were found to diminish the size of the corpuscles, such as very high temperature of the external medium, or septic poisoning. Excess of carbonic acid in the air also acts in the same way. Oxygen, on the other hand, increases the dimensions of the corpuscles, and so do, in general, all substances which depress the animal temperature, as external cold, quinine, hydrocyanic acid, and intoxicating doses of alcohol. Morphia is an exception, since,

though it generally reduces animal temperature, the corpuscles become larger under its influence. Finally, acute anæmia (produced by arterial hemorrhage) increases the dimensions of the corpuscles.— *Quarterly Journal of Microscopical Science.*

Comparative Size of Red Blood-corpuscles.— Mr. George Gulliver states in the same Journal, that recent measurements confirm his conviction that the size of these corpuscles, in families of fishes and reptiles, bears little relation to the size of the species; while in many families of birds and mammals, there is such relation, the largest corpuscles occurring in the largest species and the smallest corpuscles in the smallest species.

Vitality of Organic Germs at High Temperature.— This standard question of the experimenters in spontaneous generation, is attracting increased attention from its relation to the more fashionable question of disinfection. It is discussed in several numbers of the "Chemical News." Mr. G. E. Davis calls attention to the fact that the ovens, in which fabrics are baked for purposes of disinfection, are often irregularly heated and may vary fifty degrees from the thermometer's indication. Hence, making allowance for this uncertainty, the highest temperature desired cannot be safely attempted, and the temperature attempted may not be gained. He believes that the heat employed has little action upon the disease germs, and rather tends to encourage their growth. He advises that a vessel of carbolic acid diluted with an equal volume of water be placed near the clothing, in order to gain the combined effect of the heat and the phenol vapor.

Mr. Richard Weaver states that 350° Fahr. is the highest temperature available for disinfecting clothing: and Mr. H. B. Yardley queries whether germs might not be destroyed at intermediate temperatures although they would live at certain lower and higher degrees; thus, might not life be destroyed at 330°, which would continue to exist at 200°, 300° and 400°?

"Object Teaching" in Microscopy.— It is customary at the regular fortnightly meetings of the East Kent Natural History Society at Canterbury, England, to make dissections of plants and animals, and microscopical demonstrations of the same. The three following items are derived from the Proceedings of this society.

Size of Blood-discs.— Mr. George Gulliver predicted that

these corpuscles would soon be recognized as of importance in systematic zoology, and demonstrated the relation of their size to the respiratory function. The blood-discs of Amphiuma are the largest now known, supplanting, in this respect, those of the familiar Proteus.

Raphides and Plant-crystals.—Mr. Fullager gave demonstrations of the crystal-prisms of Quillaia bark, and noticed their size, prismatic and angular outline and polarizing properties, as points of distinction from true raphides which are acicular and occur in bundles. The order Iridaceæ abounds in crystal-prisms.

Mr. Gulliver showed the great importance of plant-crystals, especially raphides, in systematic botany; the raphidian character being so eminently natural, and so much more fundamental and general than other single diagnostics. "The shortest and sharpest diagnosis of the Onagraceæ would be Calycifloral Exogens abounding in raphides; of Galiaceæ, Corollifloral Exogens abounding in raphides; of Orchidaceæ, Gynandrous Endogens abounding in raphides; of Hydrocharidaceæ, Hydral Endogens destitute of raphides." Similar examples occur extensively in Mr. Gulliver's Memoirs in the Pop. Sci. Rev., Oct. 1865; Ann. Nat. Hist., 1861–1865; Quart. Jour. Mic. Sci., 1864, 1865, 1866, 1869; Seeman's Jour. Bot., 1864, 1866, 1867 and 1869. The crystal-prisms of Quillaia bark, shown by Mr. Fullager, and of Guaiacum, demonstrated by Col. Horsley, test the genuineness of the officinal barks; for though crystal-prisms abound in many British Endogens and in exotic Exogens they have not yet been observed in native Dicotyledons: and while true raphides are not uncommon in foreign shrubs and trees, they have not yet been demonstrated in any British trees. Sphæraphides were shown by Col. Horsley in the prickly pear (Opuntia) and by Mr. Gulliver in the Carophyllaceæ. The raphidian character of the British species of Lemna was constrasted with the exraphidian Wolffia. Of the British Euphorbiaceæ, Mercurialis alone abounds in sphæraphides; and the curious starch-sticks are equally characteristic of Euphorbia. By the raphidian diagnosis, the minutest portion of a plant may often be located in its own order as distinguished from all other orders of the same alliance.

Respiration in Abranchiate Worms.—Mr. Gulliver exhibited and described a worm, about a quarter of an inch long, of the

Naid family which abounds in pools near Canterbury. The vivid action of the vibratile cilia within the intestines, causing a rapid current of water, was seen in the pellucid segments of the thin, flat body, and was regarded as a true respiration. The same may be seen in *Sanuris variegata.*

DEVELOPMENT OF HYDRODICTYON.— Mr. Keit, of the Dublin Microscopical Club, obtained, by cultivation, two forms of this plant, an irregular network of large cells, and the ordinary nets which "appeared" to be produced from the irregular form. Further study is promised.

THE MALTWOOD FINDER.—This little accessory, used by almost every microscopist, is used under two disadvantages, the want of exact correspondence in position of the scales on different plates, and the size of the squares, in one of which, under a high power, an object may still be lost. Mr. W. K. Bridgman offers, in the "Monthly Microscopical Journal," a means of correcting these difficulties.

Each person using the finder in exchanges, is advised to prepare a common slide with a label in the centre and a dot on this, indicating the position of the centre of the central square of his own Finder. This "test slide," properly named, may be sent to any correspondent as a key to the correction if any, to be made in using *his* Finder.

The position of an object in a square must be recorded, or much of the usefulness of the Finder is lost. Mr. Bridgman indicates this position by a dot having the same relation to the figures. Thus ${}^{2\,5}_{2\,5}$ would indicate that the object was situated in the centre of the square ${}^{25}_{25}$, or ${}^{25}_{25}$. that it was far to the right of the centre. The writer (R. H. W.) has always been accustomed to record the position in the square by decimals; as, in the cases above, ${}^{25\cdot5}_{25\cdot5}$ and ${}^{25\cdot9}_{25\cdot5}$. This plan, which is convenient, and not liable to mistakes, has been mentioned to many persons, and doubtless used independently by many more, but is not recollected to have been published before. It is accurate to within one-tenth of the diameter of a square, which is quite sufficient in practice; but two places of decimals may be used, if deemed necessary, to indicate positions very near a line, as ${}^{25\cdot01}_{25\cdot5}$ or ${}^{25\cdot99}_{25\cdot5}$.

NOTES.

PHILADELPHIA.—AMERICAN PHILOSOPHICAL SOCIETY, *December 15th.*—A sum of money was appropriated for the planting and preservation of a grove of oaks in Fairmount Park, to be called the Michaux Grove, in accordance with the will of the botanist Michaux.

Prof. E. D. Cope read a paper "On the *Pythonomorpha* of the cretaceous strata of Kansas." This embraced a synopsis of the species of the order known from all parts of the world, by which it appeared that America was its home, only four species having been described from Europe. He said that the *Danubiosaurus* of Bunzel had no relationship to the group. The American species were forty-two, distributed as follows: New Jersey green-sand, 15; rotten limestone of Alabama, 7; chalk of Kansas, 17; other localities, 3. The Kansas species were referred to *Clidastes* 3 sp., *Edestosaurus* 4 sp., *Holeodus* 4 sp., *Liodon* 6 sp. Of these *Edestosaurus tortor* and *E. stenops*, *Holeodus coryphaeus* and *H. tectulus;* and *Liodon curtirostris*, *L. latispines*, *L. glandiferus*, and *L. crassartus* were described as new.

January 5, 1872.—Hon. Eli K. Price read a paper "On some Phases of Modern Philosophy," in which he combatted the views of the Heterogenists and of the Evolutionists. In the latter part of the subject he opposed the views of Darwin, asserting that the variations seen among domesticated animals had no parallel among those in a state of nature, and the fact of their ready hybridization is indication of their specific unity. He quoted Professor Wyville Thompson, to the effect that no transition from species to species had ever been observed in palæontological history; and asserted that the variations observed among animals on which the developmentalists relied in evidence of their theory, were few and abnormal, and entirely insufficient for the use made of them. That the origin of man from apes was not supported by evidence. Lastly, that the theories of evolution are highly injurious to faith and morals, and thus to Christian civilization.

January 19th.—Benj. Smith Lyman read a paper "On the Oil Bearing Region of the Punjaub," accompanied by a topographical map. He pointed out the Tertiary age of the oil-bearing beds.

Professor Cope read a paper "On a new fossil reptile from the cretaceous strata of Kansas," which was named *Cynocercus incisus*. The vertebral articular faces were deeply excavated above and below, so as to give them a transverse character. A new Crocodilian from the same region was named *Hyposaurus Vebbii*.

Professor H. Hartshorne read a paper on "Organic Physics," of which the following is an abstract:

1. The expression "organic physics" is as well justified as "organic chemistry" and "animal mechanics." For,
2. Vital force is clearly *correlated with other physical forces*, as heat, light, etc.
3. But the correlation is *not identity*.
4. Advocates of the "continuity" theory have endeavored to make it *appear* to be identity; but they will not succeed; because,
5. The effects of heat, light, electricity, magnetism and gravitation are known, and they always tend (in the absence of life) to an opposite kind of change to that which occurs under life-force; namely,
6. They form of C., H., N., S., P., and C., compounds of few equivalents and stable equilibrium; while, under life-force, the same elements are made to produce compounds of many atoms or equivalents and of unstable equilibrium; the first are mainly crystalloids, the second always colloids.
7. The directness of this opposition is especially demonstrated by the result of death (arrest of life-force), which is attended by the resolution of the *complex, unstable, colloidal* organic substances into more simple, stable crystalloids and gases.
8. Eliminating all the functions of living beings otherwise explicable, we must restrict the term "vital action," or "action of life-force," to the *conversion of inorganic into organic material*, with type-formation or organic construction as its result. It is *supposable*, at least, though not proven, that the assumption of particular forms, under given circumstances, is (analogous to crystallization) the *property* of the *bioplasm; i.e.*, given the matter, the form results as its property or attribute.
9. But chemists have *never succeeded in making organizable matter by synthesis*. Nor is it *likely* that they ever will. All complex organic substances made in the laboratory (as *urea* by Wöhler, fatty acids, etc., by Berthelot, and even, if made, crystallizable neurin) are *post-organic* (a term first used by the author); *i.e.*, results of the downward or retrograde metamorphosis; produced not by life-force as such, but by the composition or balance between life-force and the other forces; they are not germinal or formative, but *formed* and *effete* materials (Beal's terms).
10. The question of the possibility of *abiogenesis* is not yet *finally* decided. Crosse gave it momentum with his galvanized

carus; Pouchet and Pasteur have long debated it; Owen, Bennett, Clark, and a few others have of late years reasserted it; Bastian (Nature, 1870) makes an elaborate experimental defense of it. We note concerning it as follows: (*a*) The manipulation (to avoid *introducing* minute viable forms) requires an almost or quite *impracticable* delicacy throughout. (*b*) When heat is used we have always the alternative of concluding that certain minute organisms, *germs or spores*, can resist a higher temperature than was supposed, *or* that, taking for granted that the heat employed must have killed all germs, new life afterwards sprang up without parentage. All experience makes the former much more probable. George Pouchet's experiments with rotifers tend this way. Jeffries Wyman found that, although four hours boiling would not, five hours would put an end to all manifestations of life. Frankland's experiments (and Calvert's) gave similar results against abiagenesis. (*c*) Supposing (although Huxley does not) that Bastian could not have mistaken "Brownian" molecular movements for evidence of life, we yet observe that, *if* life sprang up in Bastian's apparatus, it was *such life as can exist without air or oxygen;* altogether unlike, therefore, ordinary world-life. (*d*) The assertion of Pasteur is justified, that the *onus probandi* lies with abiagenesists, since there is *no experience* of any living form *more* than $\frac{1}{1000}$ of an inch in diameter springing into life out of inorganic matter; it is, therefore, vastly *improbable* (needing most cogent evidence to prove) that any form *less* than $\frac{1}{1000}$ of an inch in size can be made to spring into life from inorganic matter.

11. While abiagenesis is *unproved*, we hold to the conclusion that vital force is *not* the mere outcome or resultant of any or all of the other cosmic forces.

12. How does it differ? Of the organic cell or "physiological unit," the most constant determinable acts or changes are *incretion and excretion;* atomic or molecular *motion*, definite in *results*, is an essential of life. Must *not the motion itself be peculiar?*

13. More definitely, we find,—that, while in the condensation of matter in the (nebular theoretical) formation of the Sun and planets, there was *integration of matter with dissipation of force as heat* (H. Spencer), life-action involves *integration of matter with accumulation of force* (*stored up* physical force in the plant of Barker; "bottled sunshine," of some one else). This is a striking contrast.

14. *Sexual* union is closely analogous to *chemical* union; instead of combustion, it makes construction by detaining products.

15. Again we notice the analogy between the spiral phyllotaxis of plants (opposite leaves a double spiral, whorls two or more, and bilateral symmetry of vertebrates and articulates and some mollusks, and radial symmetry of radiates and cœlenterates corresponding) and the spiral helix of the electro-magnet. As the

opposite chemical and polar elements of the battery are to the current of the helix, so (may be) are the polarities of the sperm-cell and germ-cell to the spiral phyllotaxis of plants and symmetrical (usually double) organo-taxis (a new term) of animals.

16. A *close* (but *reversed*) analogy exists between heat-force and vital force. A spark of fire may "light" and so burn successively an indefinite amount of *combustible* matter. A spark of life may *animate* an indefinite amount, successively of *organizable* matter. The former, combustion, *reduces* complex substances, which are unstable, to *more stable* compounds. The latter, life, *elevates* similar substances to more complex states; but with constant transmutation of their forms.

17. Such analogies are as yet crude, and do not solve the mystery of life.

18. But the facts on which they rest justify and encourage the *physical investigation* of *vital actions;* including their study *under physics; organic physics.*

19. Such a view of life is in no manner antagonistic of theism or of "teleology," any more than is the now familiar reduction of digestion, circulation, absorption, etc., to the category of chemical or physical phenomena. All such analytical inquiries are, moreover, *legitimate*, so long as they are accurate; *whether they point to biogenesis or abiogenesis; to the origin of types by interrupted appearances or by evolution.*

February 2d.—Prof. Geo. B. Wood communicated further results of his experiments with salts of potassa on vegetation, and especially on grain and fruits:

He stated that in a field of grain in which the soil had been previously exhausted by bad culture, one-half was enriched by barn manure, the other with the same with wood ashes added. The effects of the latter were especially marked, and much greater than with the former. The most striking results were obtained by the use of the ashes of the poke, *Phytolacca decandra.*

Prof. Cope read a paper on the "Families of Fossil Fishes of the Cretaceous strata of Kansas."—

The greater part of these were shown to be Physostomous Actinopteri of three families, viz.: the *Saurodontidæ*, the *Pachyrhizodontidæ*, and the *Stratodontidæ*. Of the first, four genera and ten species were described, some of them (*Portheus sp.*) among the most formidable of marine fishes. The peculiarities of the succession of teeth in *Portheus* and *Saurocephalus*, respectively, were pointed out. Of *Pachyrhizodontidæ* two genera (*Empo* and *Pachyrhizodus*) and five species were described, and of *Stratodontidæ*, three genera and seven species. *Stratodus* was a form provided with multitudes of minute shovel-headed teeth. As a general result the great resemblance of this fauna

to that of the English Chalk, was pointed out, six of the nine genera of Kansas having been found in the latter.

March 1st.—Benjamin Smith Lyman read a paper "On the Topography of the Punjaub Oil Region."

It aimed at a somewhat detailed account of the topography of the oil region; its situation, general features, special features, etc. The different places were mentioned where each kind of topography is to be seen, and its causes and simple laws pointed out; chiefly in order to show the great usefulness of careful topographical studies to geology. A short sketch of the geology of the region, aside from structure, was also added.

The general section of the rocks of the region is as follows, below the new and old alluvians:

Miocene (Sivalik) perhaps	3,000 feet
Eocene (Nammulitic), with oil, ...	1,950 "
Carboniferous, without oil, about	1,800 "
Devonian, with Saltana plaster, ...	2,850 "
	9,600 feet

The oil or asphalt (dried oil) or rock tar (melted asphalt) is found at a dozen different places, and in very small traces at half a dozen more, all within a space of a hundred miles square. They are all in Nammulitic rocks, except one in carboniferous. The deposits all seem of very small horizontal extent, sometimes only a few feet, seldom a hundred yards, once only as much as half a mile. In this case, too, the oil-bearing bed is a hundred feet thick, in one other forty, in two others twenty, and in the rest much less. The oil comes in some places from lime rocks, in others from sand rock or shale. The yield of one well was at first fifty gallons a day, but grew quickly less. like the ordinate of a parabola, and seems likely to reach 3,000 gallons in all within a year and a half. At a rough guess a hundred such wells might be bored in the region, with a whole yield, then, of hardly 7,000 barrels. The natural springs (five) yield from a gill to three quarts a day. The oil is dark green and very heavy (25 B. or less). There is nothing whatever in the Punjaub oil deposits to bear out a belief in the distillation of oil from one bed to another, or in its emanation from below or in its gradual passage from the lower parts of a bed to higher parts of the same bed, or in its origin from any source but the decomposition of organic matter in the rock. Neither is there anything here (or anywhere else) to justify wild hopes of finding large quantities of oil by boring into cavities below the oil-bearing bed. The occurrence of salt, gypsum and alum shales in large quantities is noticed; as well as that of sulphur, saltpetre, brown coal in small quantities; and that of traces of copper, iron and lead.

Prof. E. D. Cope read a paper "On *Bathmodon*," a genus of extinct Ungulates. It was represented as perissodactyl in general

characters, but with peculiarities of dentition of a combined ruminant and suilline character. There was on the outer side of the molars but one crescent, and before this a tubercle. The inner portion of the crown a tedge. Besides the species *Bathmodon radians*, a second form, *Loxolophodon semicinctus*, was referred to the group. The former animal was large as the rhinoceros, the second equal to the tapir.

Prof. Cope read a paper "On two new species of *Ornithosaurians* from the Kansas cretaceous." They were described as *Ornithochirus umbrosus* and *O. harpyia*. The former was regarded as one of the most gigantic of the Pterodactyles, extending probably 25 feet from tip to tip of the wings. The other was two-thirds the size.

Prof. Cope read a paper "On *Protostega*," a genus of extinct Testudinata. A detailed account of the osteology of *P. gigas* from the cretaceous was given, by which it appeared that the genus had separate ribs as in *Sphargis*, and that the carapace was formed by large radiating plates of bone in the skin. Two other species were described—*P. tuberosus* and *P. neptunus*. The latter, the largest known marine turtle, from New Jersey; the former, from the cretaceous of Mississippi, had been referred by Leidy to the Mosasauroids.

A discussion on Mr. Price's paper read at the last meeting took place, in which Prof. Hartshorne, Prof. Lesley, Mr. Price and Prof. Cope took part. Prof. Hartshorne supported the opposition to Abiogenesis expressed in the paper, on the ground of insufficiency of evidence in its favor, but believed in the evolution of species. Prof. Lesley objected to the insufficiency of Mr. Price's reasoning against the labors of experts in biological science, and stated that the more attention he paid to the subject, the better satisfied he became that man was descended from apes. Prof. Cope stated that Mr. Price's paper was in error as to the facts:

(1) That variability of specific type was even more common in nature than under domestication; examples from many so called "protean" genera being cited. (2) That some wild species did produce fertile hybrids. (3) That transitions between species both at the present time and in past geological periods, were common, but were concealed by a universal *petitio principii* involved in the practice of naturalists. This consisted in uniting distinct forms or species under the head of one species, as soon as the intervening connections were found. (4) That the known cases of

transition were numerous, not few; and that common induction required that we should believe of the unknown, that which we see in the known, when other circumstances were identical.

At the annual meeting of the London Geological Society, February 16, Mr. Joseph Prestwich, F.R.S., President, in the chair, the Wollaston Gold Medal was presented to the Secretary, Mr. David Forbes, for transmission to Professor Dana, of Yale College, Connecticut. The President said:

"I have the pleasure to announce that the Wollaston Medal has been conferred on Prof. Dana, of Yale College, New Haven, U. S.; and in handing it to you for transmission to our Foreign Member, I beg to express the great gratification it affords me that the award of the Council has fallen on so distinguished and veteran a geologist. Prof. Dana's works have a world-wide reputation. Few branches of geology but have received his attention. An able naturalist and a skilful mineralogist, he has studied our science with advantages of which few of us can boast. His contributions to our science embrace cosmical questions of primary importance—palæontological questions of special interest—recent phenomena in their bearings on geology, and mineralogical investigations, so essential to the right study of rocks, especially of volcanic phenomena. The wide range of knowledge he brought to bear in the production of his excellent treatise on Geology, one of the best of our class books, embracing the elements as well as the principles of geology. His treatise on Mineralogy exhibits a like skill in arrangement and knowledge in selection. In conveying to Prof. Dana this testimonial of the high estimation in which we hold his researches, may I beg also that it may be accompanied by an expression how strongly we feel that the bonds of friendship and brotherhood are connected amongst all civilised nations of the world by the one common, the one universal, and the one kindred pursuit of truth in the various branches of science."—Mr. David Forbes, in reply, said that "it was to him a great pleasure to have, in the name of Prof. Dana, to return thanks to the society for their highest honor, and for this mark of the appreciation in which his labors are held in England. It had rarely if ever occurred in the history of the society that the Wollaston medal had been awarded to any geologist who had made himself so well known in such widely different departments of the science, for not only was Prof. Dana pre-eminent as a mineralogist, but his numerous memoirs on the Crustaceans, Zoophytes, coral islands, volcanic formations, and other allied subjects, as well as his admirable treatise on general Geology, fully testify to the extensive range and great depth of his scientific researches."

The President then presented the balance of the proceeds of

the Wollaston donation fund to Prof. Ramsey, for transmission to Mr. James Croll, and addressed him as follows:

"The Wollaston fund has been awarded to Mr. James Croll, of Edinburgh, for his many valuable researches on the Glacial phenomena of Scotland, and to aid in the prosecution of the same. Mr. Croll is also well known to all of us by his investigations of oceanic currents and their bearings on geological questions and of many questions of great theoretical interest connected with some of the great problems in Geology. Will you, Prof. Ramsey, in handing this token of the interest with which we follow his researches, inform Mr. Croll of the additional value his labors have in our estimation, from the difficulties under which they have been pursued, and the limited time and opportunities he has had at his command." — Prof. Ramsey thanked the president and council in the name of Mr. Croll for the honor bestowed on him. He remarked that "Mr. Croll's merits as an original thinker are of a very high kind, and that he is all the more deserving of this honor from the circumstance that he has risen to have a well recognised place among men of science without any of the advantages of early scientific training; and the position he now occupies has been won by his own unassisted exertions.—*Nature.*

California Academy of Sciences. *March 4th.* A Communication was received from Prof. George Davidson, at present in the East, accepting the Presidency of the Academy.

A translation by Dr. A. B. Stout of an interesting paper by G. V. Frauenfeld, K. V. (of Vienna, 1870) on the "Extinct and Perishing Animals of the Earliest Epochs of the World" was read by the Secretary.

Dr. Ellinwood read a digest of a translation of the proceedings of the Society of Natural Sciences of Neuchatel, 1869–1870, giving a brief résumé of the principal discussions which occurred at the Archæological Congress at Copenhagen in 1869, being an interesting narration of the developments of antiquity, arising from an investigation of the shell mounds.

Mr. Stearns gave the result of his examination and researches in some of the numerous shell heaps and mounds at Point Penallis, Tampa Bay, Florida, near the supposed landing place of the Expedition of De Soto:—

The latter were composed of alternate thick strata of shells and thin strata of ashes; these alternations were owing to the infrequent visits of the Indians to the localities where these shell heaps are found, and during the interim between these visits a growth of grass and other vegetation had taken place, covering

the heap, which was burnt over at a subsequent visit and a thin layer of ashes was thus made and covered with shells; and this process being repeated, in the course of years, the shell heap when cut through and examined presented the appearance of a regular stratification. The shells found in these heaps are the same as many now found living in the adjacent waters. In the shell heaps and near them, as well as in the burial or earth mounds, fragments of pottery, and arrowheads of chalcedony, and other implements of stone and shell may be found; and near the Point Pinallis mounds a remarkable vase of steatite, shaped somewhat like an ordinary soup tureen, had been discovered. The material of which this vase is made was probably obtained by the Indians at Apalachicola, near which place a deposit of soapstone existed, and the material for the arrowheads was without doubt obtained at the elevated and now fossilized coral reef in Hillsborough Bay, known as Ballast Point, not far from the town of Tampa. Mr. Stearns also briefly referred to the statements of the narrator of the De Soto Expedition relative to the abundance of pearls which were seen in possession of the Indians, and which were said to be obtained by some of the soldiers of De Soto. He was of the opinion that what De Soto's men thought were pearls, were the shells of *Marginella conoidalis*. A great number of this shell had been found in an ancient mound in the city of St. Louis.

Dr. Gibbons presented a copy of the "Oriental Medical Gazette" of Constantinople, which contained a paper by Dr. Abdullah Bey, descriptive of the contents of the mounds in Europe, Asia and Africa; the writer advancing the theory that the mound works being similar all over the world, they should be attributed in their origin to one race.

Mr. Wetmore referred to some interesting developments made in the shell mounds of South America.

Prof. H. G. Hanks presented remarkably fine specimens of jasper and tourmaline from Calaveras County.

"CENTRAL PARK MUSEUM.—*Destruction of Mr. Hawkins' Restorations.*— A TIMES reporter called yesterday on Mr. B. WATERHOUSE HAWKINS in order to ascertain the truth of the allegations made in a communication which appeared in yesterday's TIMES in reference to the destruction of his restorations in the Central Park Museum. Mr. HAWKINS stated that all he had done during twenty-one months to restore the skeletons of the extinct animals of America (of the Hadrosaurus, and the other gigantic animal, which was thirty-nine feet long), was destroyed by order of Mr. HENRY HILTON, on the 3d of May last, with sledge-hammer, and carted away to Mount St. Vincent where the remains were buried several feet below the surface. The preparatory sketches of other

animals, including a mammoth and a mastodon and the moulds and sketch models were destroyed. Mr. HILTON did this, said Mr. HAWKINS, out of ignorance, just as he had a coat of white paint put on the skeleton of a whale which Mr. PETER COOPER had presented to the Museum, and just as he had a bronze statue painted white. Mr. HILTON told the celebrated naturalist who had come from England to undertake the work that he should not bother himself with "dead animals," that there was plenty to do among the living. This illustrates the policy of having such men as HILTON at the head of one of the most important Departments of the City Government. When the skeletons were dug up again, by order of Col. STEBBINS, they were found broken in thousands of pieces. Prof. Henry, of the Smithsonian Institution when he heard of this piece of barbarism, would not believe it. "Why," he exclaimed, "I would have paid them a good price for it." Mr. HILTON however, preferred to destroy the work of the naturalist which had cost the City at least twelve thousand dollars."

We copy the above from a slip cut by a friend from the "New York Times." What good will ever come to science from the million of dollars it is proposed to spend on the new building for a Museum of Natural History in the Central Park so long as the citizens of New York allow vandals and ignoramuses to hold the places that should be filled by men of culture and unquestionable scientific standing?

"WE alluded some time since to the threatened destruction of one of the most notable megalithic monuments in this country, the Great Circle at Avebury, in Wiltshire. All archæologists will be glad to hear that Sir John Lubbock has added one more to his eminent services to science by the purchase of the site on which the Circle stands. It is right also that the meed of praise should be awarded to those of the residents in the district whose zeal has been directed towards the attainment of this object, and who have thus shown their sense of the value of the monument which is one of the glories of their county. We refer especially to the Rev. Bryan King, the vicar of the parish, Mr. Kemm, Mr. George Brown, and the Rev. Alfred Charles Smith, Hon. Secretary of the Wiltshire Archæological and Natural History Society. It is to be hoped that their example will stimulate similar zeal for the preservation of monuments in other parts of the country." — *Nature.*

WHEN will Sir John Lubbock's example be followed here? Every year *our* monuments of a former race are being destroyed and no hand has yet been raised to save them.

PROF. Raphael Pumpelly *has* been appointed State Geologist of Missouri, as we are assured by a correspondent.

A French Association for the Advancement of Science, has been started. The annual meetings will be held in the various towns and cities. Over 100,000 francs, in shares of 200 francs each, have already been subscribed by the *founders* of the Association.

The Smithsonian Institution has recently succeeded in obtaining two complete skeletons of the remarkable tapir of the highlands of the United States of Colombia, known to naturalists as *Tapirus pinchaque* or *Roulini*. Previously only the skull had been obtained by Roulin, by whom it was first made known, and it was one of the rarities of the great anatomical collection at Paris. The Smithsonian Institution had before obtained a number of skulls and a skeleton of the still more remarkable tapir of Panama, which had remained undistinguished from the common species of Panama till within a few years, when first described, under the name of *Elasmognathus Bairdii*, by Prof. Gill, from two skulls in the Smithsonian collection. There are no external or dental differences between the tapirs corresponding with the marked differences in the skulls; the external differences being confined to the contour of the forehead, the color, and the character of the hair.

ANSWERS TO CORRESPONDENTS.

Sensitive Oat.—The sensitive or animated oat, as it is usually called, is the fruit of *Avena sterilis* L. It is a native of the Barbary States and the region of Gibraltar, but as it is not unfrequently cultivated as a curiosity it has become sparingly introduced in many places. Although not often found in gardens in this region, there will be no difficulty in getting seed from any of the larger dealers or florists.—W. G. F.

BOOKS RECEIVED.

Zoological Record for 1870; being vol. 7 of the Record of Zoological Literature. Edited by Alfred Newton. 8vo, pp 523, cloth. London. Zoological Record Association. 1871.

Handbook of British Fungi, with full Descriptions of all the Species and Illustrations of the Genera. By M. C. Cooke. 2 vols., 8vo, pp. 981. 407 woodcuts and a colored plate, cloth. London and New York. Macmillan & Co. 1871.

The Metric System of Weights and Measures; an Address delivered before the Convocation of the University of the State of New York, at Albany, Aug. 1, 1871. By Frederick A. P. Barnard. Revised edition, printed by order of the Board of Trustees of Columbia College. 8vo, pp. 194. cloth. 1872.

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HINTS ON HERBORIZING.

BY A. H. CURTISS.

As there are many persons, especially in the country, who desire to acquire a scientific knowledge of the world of vegetation which surrounds them, but who, for the lack of competent instructors, do not know *how to commence*, the following brief directions, offered at the commencement of the floral season, will probably prove serviceable to many readers of the NATURALIST, and may perhaps afford some new ideas to experienced botanists. Any one having a capacity for study may learn the name and natural relationship of any flowering plant by an intelligent use of a good descriptive work on botany—first reading, as a necessary drudgery, an elementary treatise on the structure of plants. But no one can be a good botanist without a good herbarium, which is composed of dried specimens of species and their various forms arranged in systematic order and accurately labelled. The formation of a good herbarium is no simple task, and desultory, unguided efforts will surely be attended with much loss of time and many sources of discouragement.

Scientific characters are taken from the fruit and leaves as well as from the flowers, and often the roots are very important; therefore, a mere sprig of flowers does not constitute a "botanical specimen." A plant not over three or four feet high should generally be preserved entire, doubling it upon itself once or twice if too long for the herbarium sheet—the most approved size of which is eleven and a half by sixteen and a half inches—

of very large herbs, the upper portion and a lower leaf must suffice, and of shrubs and trees a branchlet. Specimens of most herbs may contain both flowers and fruit, but of most shrubs and trees the flowers are to be collected early in the season and the fruit with mature leaves later. Sedges should be collected only in mature fruit.

Specimens are usually brought home either loose in a tight tin box or pressed flat in folded sheets of thin paper carried in a stout portfolio: but good specimens are more easily prepared by using a portable press. This consists of two light but strong boards half an inch thick, fifteen and a half inches long, and ten and a half inches wide; this size will prevent specimens from being made too large or unnecessarily small. Between these place a pile of driers of the same length and width, each consisting of a sheet of rag paper folded in quarto with a folded sheet of tea paper inside to hold the specimens till dry. Straw paper, however thin, should never be used. The whole is to be bound together with a stout strap, and may have an oil-cloth cover. Arrange each specimen naturally, showing both sides of leaves and flowers, and fold down the upper half of the drier carefully upon it, seeing that the leaves, etc., lie smoothly; carelessness in preparing a specimen is unpardonable, for it may be destined to be preserved for centuries. Next morning transfer the sheets of specimens to the house press, for which there should be provided a great number of driers, about twelve by eighteen inches in size. The best kind of drying paper may not easily be obtained, but newspapers answer very well. The press should be divided by boards into sections, ticketing each to show whether it is to be changed the next day or the day after, and assort the specimens accordingly. Do not take out the specimens till perfectly dry; and, if plenty of driers are at hand, transfer the specimens when nearly dry to another press, and let them remain a week or two; most grasses and sedges, and many other plants, may be transferred to this at the first change. Build up the piles compactly, with thick strips around the edges, so that all may receive uniform pressure from the fifty to seventy-five pounds of weights to be placed on top. Succulent plants may be dried quickly by placing them in a separate press near a stove; the heat may be so great that a thick specimen at top will dry in a day, but care should be taken to remove them as soon as dry. Besides Monocotyledons and Saxi-

fragex this treatment should only be applied to plants that incline to mould or fall to pieces (Coniferæ are not benefited by it). To dry the damp driers effectually without spreading them all over the room, cut a hole in one end of each and string them on a stout wire and suspend this on hooks set in the under-side of a shelf. Pieces of stiff paper with a slit in the middle are useful for confining specimens of sedges, etc., where bent, and folded pieces of oiled paper for adhesive flowers, etc.; also rings of cotton for thick heads of ligulate Compositæ. The color of plants is best preserved by rapid drying, but not much attention should be paid to this point, as they will fade in a few years. If such plants as the purple Arisæma and Symplocarpus or an orange Lilium be dried in a few minutes by *ironing* them in their driers, they will look when mounted like paintings.

Specimens may be mounted for the herbarium on sized paper with glue, or on unsized paper with touches of poisoned paste and strips of gummed paper. Never mount a small specimen on the centre of a sheet, nor any specimen without first poisoning it, which is done by washing with an alcoholic solution of corrosive sublimate just weak enough not to show. A pile of duplicates, if infested with insects, should be inclosed for a while in a close vessel with an ounce or two of chloroform or cyanide of potassium. A few grains of the latter introduced into a case of entomological specimens will quickly destroy all intruders. It is best to keep each genus in a manilla cover and these in piles on the shelves of a cabinet.

The earliest flowering plants being on the whole most difficult, the beginner will meet with many discouragements at first; but every step will add to his strength. Any locality will afford from five hundred to eight hundred species of flowering plants, and, in determining so large a number, mistakes are inevitable; therefore, it is well to send a set of specimens, numbered to correspond with one retained, to some person having a good herbarium, who will doubtless be willing to examine and name them in return for the specimens. The same may be done if the determination of names is not attempted at all, but great care should be taken to see that the two sets exactly correspond, for there is great danger of confounding closely related species, as also of mistaking marked forms for different species.

The plants of other sections may be easily obtained by ex-

changing with other collectors. A person before commencing this system should procure the "Naturalists' Directory" and the "Catalogue of Plants" from the Naturalists' Agency at Salem, to which it would be safest to apply for the best works to be studied.

If one expects to collect year after year for exchange, it is very advantageous to keep a record of the time when the best specimens of each species are to be obtained, which will be found to be an invaluable aid in following seasons. System in scientific work is of the greatest importance, and with this and patient perseverance and economy of time, great results may be accomplished.

USE OF THE RATTLES OF THE RATTLESNAKE.

BY J. G. HENDERSON.

It seems that the singular structure from which the subject of these notes derives its name, was intended as a special stumbling block in the path of antidarwinists, or to intensify the "struggle for existence" which the Darwinian theory, like all other theories must undergo.

In most notices I have seen of the rattles of the rattlesnake. they have been mentioned as though they were of no advantage to the possessor, and that natural selection would never produce them but on the contrary would weed them out, if that theory were correct. It seems to me that the whole trouble in the matter arises from the assumption that the sound of the rattles, as a war-cry, is a disadvantage to the reptile, by calling the attention of its enemies to it and thus inviting its own destruction, and that consequently the only way to reconcile the existence of the rattles with the theory of Darwin, is to show that there is some other use made of them and that in striking the balance between the profit and loss sides of the ledger, the line falls on the side of the former and for that reason natural selection produced and retains the rattles. If I understand him rightly, this is the view of the matter taken by Prof. N. S. Shaler in his paper in the January NATURALIST. He says that for some years he has "been teaching that the tail appendage of the rattlesnake was not to be explained

upon the theory of natural selection, inasmuch as it could contribute in no way to the advantage of the animal; that it seemed to him quite clear that it was rather calculated to hinder than to help the creature in the race of life by warning its prey of its presence." But he intimates that he is now ready to say, that this appendage can be explained upon the theory of natural selection. He considers the idea that it might be used as a sexual call as untenable, but that the whirring sound of the rattles closely imitates the sound made by the Cicada and for this reason is used as a call-note, as a hunter uses his bone-turkey-caller, to induce the bird to come within the range of his weapon. Now the first question which naturally arises is this: Does the snake sound its rattles when seeking to capture its prey? I have always understood that it is only when it throws itself upon the defensive and prepares for battle that the rattles are sounded; that it is an alarm note, a war-cry, and not a gentle, deceptive invitation to the victim. I have never seen a rattlesnake, and know of course nothing personally of its habits. But if this use is not made of the rattles as suggested by Prof. Shaler, and the sound only serves to call the attention of its enemies and thus invite destruction, then indeed is the theory of natuıal selection nonplussed. But as I view the matter, instead of inviting his destruction by sounding the rattles, it is one of the most effective means of self protection and is as useful to it in the race for life as is the growl of the tiger when threatened with danger. The snake does not sound its rattles until it considers itself discovered, and not then unless it apprehends danger. It throws itself in position to strike and says in unmistakable language, "Look out, I am ready for you!" If pushed upon, it makes its leap at its antagonist, and again throws itself in position to renew the conflict, and again sounds the note of defiance; a note calculated to alarm and, like the war-whoop of the Indian, strike terror to the heart of the assailant; but it may be said that the Indian only utters his yells when rushing on his enemy, or when actually engaged in the conflict, and the sounding of the rattles upon the first approach of danger is a disadvantage. Now it seems to me, if this were true and if it be a piece of rashness upon the part of the snake thus early to exhibit his combatativeness, that natural selection would cure the matter by selecting and preserving the more timid, and that, eventually, rattlesnakes would only sound their tail-bells when it would best promote their interests.

We are not to judge of the advantage or disadvantage of the rattles by their effect upon the nerves of man alone, though no doubt many a man has turned his back and been deterred from making an attack by the sound of these rattles and the defiant attitude of their possessor.

The ability of the snake to defend itself does not consist in its strength or size, or in its power of overcoming its adversary by a prolonged conflict, for most of its enemies are its superior in size and strength. Nor does its deadly poison act quickly enough to secure its own safety when it is attacked, but, in most cases, the victim, after the deadly stroke is given may still revenge itself by the destruction of the snake. But the *certainty* of the effect of the poison serves as a warning and is advantageous, not in defense after the attack is made, but in *preventing* an attack from being made. If, then, the color of the rattlesnake were different from all harmless snakes, so much so as to render it conspicuous, this would be beneficial to it, by the readiness with which all animals would recognize it, and thus protect the snake by this notice of the deadly character of its weapons. If then a conspicuous color would be of advantage, it seems to me that any other means which it may be able to use in making known its character to any animal that may come near it, would be advantageous, and would be increased and preserved by natural selection, and that the whirring noise which it produces, in this view of the matter, admirably serves its purpose. In effect it amounts to this, and by experience its enemies learn to understand its language, "I am a *rattlesnake*, armed with what will be death to you if you come too near; give me a wide berth!"

Prof. Shaler remarks that it is a fact well known doubtless to those who have observed serpents, that many when in a state of excitement vibrate the end of their tail just as the rattlesnake does. This statement reminded me of a South American species described by Darwin in his "Voyage of a Naturalist" (vol. i, p. 123, Harper's ed.), where he says: —

"Of reptiles there are many kinds: one snake (a Trigonocephalus, or Cophias), from the size of the poison channel in its fangs, must be very deadly. Cuvier, in opposition to some other naturalists, makes this a sub-genus of the rattlesnake, and intermediate between it and the viper. In conformation of this opinion I observed a fact, which appears to me very curious and instructive, as showing how every character, even though it may

be in some degree independent of structure, has a tendency to vary by slow degrees. The extremity of the tail of this snake is terminated by a point, which is very slightly enlarged; and as the animal glides along, it constantly vibrates the last inch; and this part striking against the dry grass and brushwood, produces a rattling noise, which can be distinctly heard at the distance of six feet. As often as the animal was irritated or surprised, its tail was shaken; and the vibrations were extremely rapid. Even as long as the body retained its irritability, a tendency to this habitual movement was evident. This Trigonocephalus has, therefore, in some respects, the structure of a viper, with the habits of a rattlesnake; the noise, however, being produced by a simpler device."

It was these remarks of Darwin that first suggested the problem of the rattlesnake's tail to my mind, and, as I had thought considerably about the matter, of course I was deeply interested in the paper by Prof. Shaler; but I must acknowledge that, while many of his suggestions are correct and highly valuable, I was disappointed to find that the only advantageous use, in his estimation, of this tail appendage of the rattlesnake, is an imitative call-note to allure birds within its reach, and that, otherwise, it is rather a disadvantage than an advantage to be preserved and perfected by natural selection. If it is useful for both purposes, then there is a double reason for the action of natural selection. If it is not used as an imitative call-note, but is useful in the manner I have pointed out, then I have shown that it is explained by natural selection.

ORNITHOLOGICAL NOTES FROM THE WEST.

BY J. A. ALLEN.

I. NOTES ON THE BIRDS OF KANSAS.

In the spring of 1871 an expedition to the Plains and the Rocky Mountains was sent out by the Museum of Comparative Zoölogy, under the charge of the writer. During the nine months spent in the field by the party in question, the department of ornithology received a large share of attention. In the following pages it is proposed to give a hasty résumé of such observations

as may be supposed to interest the ornithological readers of the NATURALIST, reserving a more detailed and formal report for publication elsewhere.*

Leavenworth, Kansas, was the point at which we commenced our labors. During the ten days spent at this locality we collected or observed nearly one hundred species of birds. Although we arrived here May 2d, the country wore the aspect of a New England June. The prairies were already green with waving grass and the forests were nearly in full leaf. The apple trees were some days out of bloom, and the young cherries were as large as very large peas; the vegetation being fully a month in advance of its usual stage in Southern New England at the same date. Comparatively few of the birds, however, were nesting; some had not arrived from the South, and others whose breeding stations were more to the northward still lingered.

We found in the vicinity of Leavenworth a collector's paradise, the forests of the Missouri bottom-lands literally swarming with birds, many of which none of the party had before seen in life, the general aspect of the ornithological fauna being strikingly diverse from that of the northeastern states. The red-headed and red-bellied woodpeckers (*Melanerpes erythrocephalus* and *Centurus Carolinus*) revelled among the grand old elms and cottonwoods of the bottom-lands, some of which tower to the height of one hundred to one hundred and fifty feet. The golden-shafted flicker (*Colaptes auratus*) was almost equally abundant, and showed its close affinity with its red-shafted brother of the mountains and the Pacific Slope (*C. Mexicanus*) by already frequently presenting touches of red in its black cheek patches. Although the hairy and downy woodpeckers (*Picus villosus* and *P. pubescens*) were both observed, they seemed by no means common. The crested titmouse (*Lophophanes bicolor*) and the merry cardinal (*Cardinalis Virginianus*) vied with each other in their noisy demonstrations, both being exceedingly abundant and garrulous. Their vocabulary seemed inexhaustible, as they every day astonished us with new sounds, which we often at first supposed to proceed from some bird hitherto unknown to us. The blue jay (*Cyanura cristata*) was equally

*This report will embrace annotated faunal lists for eight localities, with a general summary list for the whole. Mr. C. W. Bennett accompanied the expedition as taxidermist, and Mr. Richard Bliss as ichthyologist, both of whom, especially the former, greatly aided in the ornithological work.

at home, and as vivacious and even more gayly colored than at the north. While he seemed to have forgotten none of the droll notes and fantastic ways one always expects from him, he has here added to his manners the familiarity that usually characterizes him in the more newly settled parts of the country, and anon surprised us with some new expression of his feelings or sentiments,—some unexpected eccentricity in his varied notes, perhaps developed by his more southern surroundings. The yellow-breasted chat (*Icteria virens*) disported himself among the tangled underbrush, and seemed highly to enjoy the discomfiture to which he often put us, through his well-known ventriloquial accomplishments, in our search for his exact whereabouts. The Carolina wren (*Thryothorus Ludovicianus*) was more or less common, and already had young full-fledged on our arrival, while the only other birds then found breeding were the cardinal, the towhe and the brown thrush. Most of these, however, were still pairing and nestbuilding. The common chickadee (*Parus atricapillus*) and the house wren (*Troglodytes aëdon*) were both common, but were far less numerous and much more retiring than their more demonstrative southern relatives already mentioned.

Among the warblers three southern forms were the most common, their bright colors often attracting the eye as they flitted through the openings among the trees. These were the Kentucky (*Oporornis formosus*), the hooded (*Wilsonia mitrata* Bon.) and the blue-winged yellow (*Helminthophaga pinus*). They seemed aware that they were especial objects of attention to the collector, and took good care not to exhibit themselves unnecessarily. The golden-crowned warbler (*Helminthophaga celata*) was also one of the most numerous of the *Sylvicolidæ*. The Nashville (*H. rubricapilla*), the blue yellow-backed (*Parula Americana*) and the black and white creeper (*Mniotilta varia*) were likewise moderately frequent. The beautiful cærulean warbler (*Dendrœca cærulea*) was met with a few times, the Blackburnian (*D. Blackburniæ*) once or twice, and the yellow rumped (*D. coronata*) but once, though the latter was doubtless common somewhat earlier in the season. The yellow warbler (*D. æstiva*) was more or less common along the outskirts of the forests; the chestnut-sided (*D. Pennsylvanica*) was by no means rare; redstarts (*Setophaga ruticilla*) were seen but a few times, and the Maryland yellow-throat (*Geothlypis trichas*) was far from numerous.

Of thrushes, by far the most common was the wood thrush (*Turdus mustelinus*), which was abundant. Although it was the pairing season, they were comparatively quite unmusical, their song being shorter, and, it seemed to me, far inferior to that of the representatives of this species at the North. The birds were also much less wary, being easily approached. I shot five or six in half an hour during one of our excursions, and might have easily got as many more had not rarer species more especially attracted my attention. The olive-backed thrush (*T. Swainsonii*) was also common, but save the brown thrush (*Harporhynchus rufus*) and the catbird, which were both tolerably numerous, no other thrush, not even the robin, was met with. The common eastern bluebird (*Sialia sialis*) was frequent, especially near the borders of the forests.

Of vireos, three species only were seen, — the red-eyed, the warbling and the white-eyed, all of which were moderately and about equally frequent. The logger-headed shrike (*Collurio Ludoviciana*) was occasionally seen, generally along the edges of the prairie.

Harris's finch (*Zonotrichia querula*) was, next to the cardinal, the most abundant species of the family of sparrows and finches, as it was also one of the largest and handsomest. It almost exclusively frequented the damper parts of the woods, associating with the white-throated sparrow (*Z. albicollis*), much resembling it both in habits and song. The white crowned (*Z. leucophrys*) and Lincoln's sparrow (*Melospiza Lincolnii*) were each a few times met with. The song sparrow was scarcely observed; the swamp sparrow was common, as were also the chipping and field sparrows. The beautiful lark finch (*Chondestes grammaca*) was among the rarer species. The towhe was numerous and the indigo bird (*Cyanospiza cyanea*) made its appearance in considerable numbers soon after our arrival. The black-winged red bird, or scarlet tanager, was the only representative we saw of the tanagers. It was, however, abundant, and though so gorgeously arrayed at the north, the intensity of its colors was appreciably greater here.

Of the *Icteridæ*, the Baltimore and orchard orioles were both abundant, the Baltimore indulging in a dialect so different from that of its northern relatives as often to puzzle us to make out to what bird its strange notes belonged. Its colors, also, were

unusually bright in all the specimens examined. The red-winged blackbirds and the purple grackle (*Quiscalus purpureus*) were both numerous, the latter presenting the brassy tints somewhat peculiar to the western race of this flexible species. The lazy, ubiquitous cowbird (*Molothrus pecoris*) was ever lurking in the trees and bushes, watching for an opportunity of shirking the burden of hatching and rearing its young upon some more industrious neighbor, wholly oblivious of respectability and fair play in respect to its domestic affairs. On the prairies the meadow lark (*Sturnella Ludoviciana*) filled the air with the wild, sweet melody so characteristic of this bird in the prairie states.

Among the swallows, the purple martin (*Progne subis*) was one of the most numerous, breeding in all parts of the city in boxes liberally provided for their accommodation. This bird seems to be a universal favorite in the more newly settled parts of the west, the erection of martin boxes being one of the settlers' first "improvements." Hence this bird is often common where none could exist without man's kindly aid. The barn, cliff, white-bellied, bank and rough-winged swallows were also more or less common. The swift (*Chætura pelasgia*) was quite numerous, breeding chiefly in the hollow trees of the forest, which it always seems to prefer to chimneys, to which it has to resort in most of the longer settled districts, or else abandon the country.

The Carolina dove was abundant almost everywhere; the quail (*Ortyx Virginianus*) was equally numerous, but affecting chiefly the neighborhood of thickets. The prairie chicken still forms the chief game bird of the prairies.

Of birds of prey few were observed beyond such almost universally common species as the marsh hawk and the sparrow hawk. The latter was nesting abundantly in woodpeckers' holes in the forests. Between this bird and the red-headed woodpecker we witnessed many fierce encounters, the woodpecker being usually the aggressor, but by no means always the victor.

The few water birds seen were chiefly of the following species: spotted and solitary sandpipers, both common; the lesser tell-tale or "yellow legs" (*Gambetta flavipes*) and the red-backed sandpiper (*Pelidna Americana*) were also quite numerous about the lagoons, which were also inhabited by an abundance of "mud hens" (*Fulica Americana*), and frequented by teals, mallards and wood ducks. Our stay being so short at this interesting locality, many birds

were doubtless to be found here of which we met with no examples.

Leaving Leavenworth, our next stop was at Topeka, where we also tarried for ten days, devoting the time almost exclusively to ornithologizing. Here also we observed about one hundred species, including a few not met with at Leavenworth, while some birds that were among those most numerously represented there, were not seen at Topeka. Among those especially missed was Harris's finch, and among the new forms Bell's vireo, Nuttall's whippoorwill and the yellow-headed blackbird were the most noteworthy. As Bell's vireo did not appear here till some days after our arrival, it may be expected to be equally numerous at Leavenworth, as the ornithological fauna of the two localities is essentially identical, the distance between them being less than a hundred miles, and both being in nearly the same latitude.

At no point have I ever met with birds in greater abundance than at Topeka, either in individuals or species. On the day of our arrival there I counted, during a half hour's stroll in the woods near the town, about thirty species, of most of which I observed several individuals, whilst several of them were extremely abundant. This may result from the trees being restricted to a narrow belt along the Kaw river, thus crowding all those more or less restricted to a timbered country into a comparatively limited area. The trees here are smaller than along the Missouri, less crowded, and with a thicker undergrowth. Considerable areas were covered with quite young trees, forming, with the dense undergrowth of hazel, dwarf oak and sumach bushes almost impenetrable thickets; and the forests were broadly fringed with a dense growth of these bushes, extending at times far out on the prairies. These brush patches were the favorite haunt of the yellow-breasted chat, the black-throated bunting and the several species of *Spizella*, among which we here first met with the *S. pallida*, or clay-colored sparrow. The chats were so abundant that three or four to half a dozen would be sometimes seen hovering and singing in the air at once, each striving to outdo the other, in grotesque manœuvring and in song, while a dozen or two black-throated buntings would be also in sight or hearing engaged in a similar vocal rivalry. Although the males of the latter species were so numerous, a female was rarely seen. Whenever one ventured into sight the males would most ungallantly start in

pursuit of her, and oblige her to seek concealment again,—a treatment similar to that indulged in by the bobolink toward his "better half." The thinner portions of the wooded area were the favorite haunts of Bell's vireo, which immediately upon its arrival became one of the most numerously represented species. They very soon commenced pairing, the males almost incessantly uttering their rather pleasing though peculiar and feeble song.

Among the other later arriving birds was the golden-crowned wagtail (*Seiurus aurocapillus*) and the swallow-tailed kite (*Nauclerus furcatus*). The former appeared on the 15th of the month (May), and immediately the woods were ringing with its familiar song. The arrival of this bird so late in the season was quite unexpected, the trees being not only in full leaf, but vegetation generally was quite far advanced, strawberries being already ripening in abundance in the fields, whilst for days the temperature had been that of July in southern New England. This interesting little woodland songster is pretty sure to make his appearance in Massachusetts with the earliest unfolding of the leaves, arriving there rather earlier than we this year observed it to appear in Kansas.

At this place we saw the only robins — a single pair — and the only cedar birds (one or two small flocks) met during our sojourn of over two months in the state of Kansas. The blue-gray gnatcatcher (*Polioptila cœrulea*) was here also met with once, and the only time in the State.

Leaving Topeka May 24th, we arrived the following day at Fort Hays, situated some three hundred miles west of the Missouri river, and fairly out on the "Great Plains." The only timber found here consists of a somewhat interrupted fringe of elms, box elder and cottonwoods along the streams, and this entirely disappears a few miles further to the westward. We hence have here all the characteristic birds of the plains, in addition to many eastern species that follow the timber up the streams as far as timber regularly extends, even after the timber belts become extremely restricted and irregular. Remaining five weeks in the vicinity of Fort Hays enabled us to become thoroughly familiar with the ornithology of this peculiar region, our excursions extending in different directions from fifteen to thirty miles from the Post, which, through the hospitality of the officers in command, formed our headquarters and base of operations.

When we arrived here the plains were everywhere covered with a carpet of short fine grass, varied with large patches of brightly-colored flowers,—yellow, orange and various shades of red and purple,—forming a landscape beautiful beyond description. Gradually the earlier plants passed out of bloom, the hot dry winds of June parched and withered the grass, and when we left, the first week in July, only the belts of deep green formed by the foliage of the trees along the streams, presented anything agreeable to the eye, these being doubly refreshing from their contrast with the almost desert-like aridity surrounding them. The daily maximum temperature ranging during our stay from about 90° to 108° F. in the shade, the reader may readily perceive the semi-tropical character of the summer climate of the Plains.

The total number of species observed here was sixty-one, about ten per cent of which were by no means common. Among the species inhabiting the timber, the kingbird, the Arkansas flycatcher (*Tyrannus verticalis*), the purple grackle, red-headed woodpecker and the Baltimore and orchard orioles were by far the most common, all of which in fact were numerously represented. The brown thrush, the mockingbird, the black-headed grosbeak (*Guiraca melanocephala*), the chickadee (*Parus atricapillus*), the golden-shafted flicker, the warbling and Bell's vireos, and the common wren (*Troglodytes aëdon*) were all more or less frequent. The kingfisher was occasional, and the Carolina dove everywhere abundant, far out on the Plains as well as in the vicinity of the timber. The rough-winged swallow was also common, and colonies of the cliff swallow were met with breeding on the cliffs in the vicinity of the streams. A few purple martins were seen near the Post; night-hawks were abundant, resting on the trees during portions of each day, and breeding out on the plains. They were mostly of the pale variety commonly known as *Chodeiles Henryi*, but different specimens varied greatly in color, some being nearly as dark as eastern ones. The cowbird was seen far out on the Plains as well as in the timber, but was nowhere numerous.

The birds that may be regarded as characteristic of the Plains were chiefly the following: the meadow lark (*Strunella Ludoviciana*) everywhere abundant, representing typically the pale form of the Plains known as *S. neglecta*. Its notes, however, were quite different from those of the representatives of this species living

to the eastward in the prairie states, being less varied and ringing, and more guttural. The horned lark was equally characteristic, being by far the most numerous species here met with. During the excessive heat of midday it was seen crouching with half open wings in the shade of some tussock of herbage; whilst in winter, when it is equally abundant, it is not uncommon to meet with considerable numbers that have died of the extreme cold, as was the writer's experience the past winter. The yellow-winged sparrow is also one of the most abundant species. The pine wood finch (*Peucea æstivalis*) of the South Atlantic and Gulf States, or rather the representative of that species, was quite frequently met with near the streams, where its sweetly modulated song greets the ear with the first break of dawn, and is again heard at night till the last trace of twilight has disappeared. It is here very appreciably paler than the race of *P. æstivalis* found in the pine barrens more to the eastward, though not otherwise sensibly different. It here constitutes the variety of this species known in the books as *P. Cassinii*. The lark finch (*Chondestes grammaca*) was also common, but affected chiefly the vicinity of the streams and damp hollows. The yellow-headed blackbird, whose biography was so well written sometime since in the NATURALIST * by Dr. Coues, was also a few times met with. But by far the most interesting species were the chestnut-collared bunting (*Plectrophanes ornatus*) and the lark bunting (*Calamospiza bicolor*), because both are not only characteristic of the region, but they are among the few birds strictly confined to the arid plains. Both were quite abundant, but were only met with on the high ridges and dry plateaus, where they seemed to live somewhat in colonies. At a few localities they were always numerous, but elsewhere were often not met with in a whole day's drive. They were rather wary, and very tenacious of life, often flying long distances when shot through vital parts. Most of the many specimens procured by us had to be killed on the wing at long range. Both are strong fliers and seem to delight in flying in the strongest gales, when all the other birds appear to move with difficulty and generally lay concealed among the grass. Both sing while on the wing, the lark bunting hovering in the wind, and shaking its tail and legs after the well known manner of the yellow-breasted chat. Indeed its song strongly

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* Am. Nat., Vol. v, p. 195.

resembled the song of the chat, with which at such times its whole demeanor strikingly accords.

Among rasorial birds, the quail and the prairie chicken, both very recent emigrants, it is said, from the East, were occasional, and here reach their present western limit. The wild turkey is still abundant along all the more heavily wooded streams. The sharp-tailed grouse is also common, especially to the northward of Fort Hays.

Hawks were by no means numerous, excepting perhaps, the marsh hawk, which was moderately frequent. A single pair of duck hawks (*Falco peregrinus*) was found breeding on a cliff near the Saline, and one nest of the red-tail was found. Sparrow hawks were also occasionally seen near the timber, and a single pair of ravens was observed. The black vulture (*Cathartes aura*) was also frequent but far less numerous than would naturally be expected, from the abundance of food afforded them by the thousands of carcasses of decaying buffaloes that are scattered over the plains. The little burrowing owl (*Athane hypogea*) was seen at intervals, living in colonies in the prairie dog towns.

Water birds were few, the only ducks seen being a few representatives of the wood duck and the green-winged teal. The spotted sandpiper was more or less frequent along the streams, but the killdeer plover was by far the most numerous representative of the *Grallæ*. The so-called "mountain" plover was also occasional, and generally seen on the dry prairies far away from the streams and sloughs. A single stray representative of the Esquimaux curlew (*Numenius borealis*) and a single small colony of the long-billed curlew (*N. longirostris*) were also observed, the latter breeding. The only herons seen were one or two examples each of the little green heron and the night heron.

A few weeks passed near Fort Hays, in mid-winter, enables me to add a few notes respecting the winter birds of the Plains. One species only of the summer birds was met with in numbers in winter. This was the horned lark which was exceedingly numerous. The snow bunting was also abundant, and the Maccown's longspur (*Plectrophanes Maccownii*) tolerably frequent. The tree sparrow was occasional along the streams wherever there were bushes; the rough-legged buzzard was the most common hawk. None of the remaining twenty-four species of the total number of thirty observed, were numerously represented, and

were such as from their general known distribution would be expected here. Neither the bluebird nor the meadow lark was observed, but the kingfisher and golden-shafted flicker were both occasional.

In conclusion, some peculiarities in the nesting habits of some of the birds observed in Kansas are worthy of notice. A nest of the purple grackle was found in an old woodpecker's hole. Although this is the only instance of the kind I have as yet observed, my friend Mr. Wm. Brewster, of Cambridge, informs me that he has repeatedly found the same species breeding in woodpeckers' holes in Maine! The Carolina dove generally bred at Fort Hays in trees, as at the eastward; sometimes, however, laying in an old grackle's nest instead of being at the trouble of building one. One nest, however, was found *on the ground*, although bushes were growing but a few yards distant. More to the westward I learned that this bird—more common here than at the east —*always breeds on the ground*, as it is of course compelled to do, owing to the absence of either trees or bushes. Meeting with this bird in pairs in the breeding season far out on the Plains, sometimes ten miles from the nearest trees, led me to believe that this would be its habit, even before I had seen positive evidence that such was the case.

Other interesting instances of the modification of nesting habits may well be mentioned in this connection. The brown thrush is well known to vary the location of its nest according to the nature of the soil, nesting on the ground in sandy districts, and in bushes where the soil is damp or clayey. Among the clayey bluffs at Leavenworth we found it nesting in bushes; at Topeka on the ground; at Fort Hays in bushes, when breeding on high ground, and in trees, ten to fifteen or twenty feet from the ground, when nesting in the timber along Big Creek (a considerable stream on which Fort Hays is situated). We had an ample explanation of this latter departure from its usual habits during our stay at Fort Hays. Big Creek, flowing in a deep narrow bed, is subject, in summer, to sudden freshets, resulting from occasional heavy rainfalls, it rising sometimes ten or a dozen feet in a single night, as we once witnessed. The trees growing chiefly along the bed of the stream, the water at such times submerges not only the scanty underbrush, but all the lower branches of the trees. Hence the brown thrush, as well as all the other birds, appears here always to

select high nesting sights. Can such foresight be regarded as the result of "blind instinct?" As the highwater line is always indicated by the drifted matter lodged in the trees, is not this precaution the result rather of a rational appreciation of the exceptional dangers here to be guarded against, and this caution in the selection of a safe nesting site really the result of induction?

The cliff swallow (*Hirundo lunifrons*) we found breeding throughout the West in its primitive way, that is, on the faces of cliffs; yet where such natural facilities abounded they in some instances abandoned the rocks for the more sheltered nesting sites afforded them by buildings, plastering their mud dwellings against the building under the projecting eaves. At Topeka, however, we saw cliff swallows frequenting the *holes in the banks* of the Kaw River made by the sand martin, keeping in the company of these birds, entering their holes and presenting the same appearance of breeding in them as the sand martins themselves! Throughout the mountains of Colorado we found the violet-green swallow (*Hirundo thalassina*) breeding in abandoned woodpeckers' holes; but in the "Garden of the Gods", near Colorado City, they were nesting in holes in the rocks. We had good evidence also that the sparrow hawk bred there in the same manner,—in holes in the cliffs instead of in hollow trees! At Ogden, Utah, we found the red-shafted flicker frequenting holes in a high bank, and that these holes entered horizontally for a few inches only and then turned abruptly downward, having the same form they would have if made by this bird in a decayed tree. These circumstances left no doubt in our minds that these birds nested in the holes in the bank we saw them entering, although it was then past the breeding season. The region being but scantily wooded for many miles, there is certainly some reason for such a modification of their habits. While on this subject I may add that every collector must have noticed how much birds vary the material used in the construction of their nests with locality, using generally whatever is most easily obtained that is serviceable. Nests of the same species from different localities hence often differ greatly in appearance, enabling one sometimes to determine approximately the locality whence the nest came by the materials used in its construction.

Finally, I wish briefly to notice some peculiarities in the color of the plumage of the birds inhabiting the Plains. From

the extreme dryness of the atmosphere, the want of shelter from the intense rays of the sun — an intensity one can hardly appreciate until he has passed a few summer days far out on the Plains — and the dry, heated powerful winds so constant here, few would be surprised at the faded, bleached and worn plumage that characterizes the birds of the Plains. It is more noticeable of course in those that do not frequent the timber, though more or less apparent in all. Here the common "house" wren is bleached and faded, forming the so-called *Troglodytes Parkmanni*, differing from the *T. aëdon* of the east only in this particular. The meadow and horned larks look singularly "weather worn," the former constituting the *Sturnella neglecta* of authors, and the latter the *Alauda rufa* of Audubon, in which the yellow almost entirely disappears from the forehead, throat and lores, fading to white. The night-hawk becomes much lighter and paler, forming the race known as *Chordeiles Henryi; Peucea æstivalis* wears a very faded aspect, and forms the so called *P. Cassinii.* The yellow-winged sparrow becomes equally faded and changed, and the killdeer plover shows a similar paling of the colors, which is also noticeable in birds as brightly colored as the Baltimore oriole. The color of the mountain plover is in similar harmony with the midsummer gray tint of the plains. In respect to the Baltimore, we find here a well marked race, characterized by the middle coverts of the wing being *white* instead of bright yellow, and by having much more white on edges of the secondaries. The bill is also slenderer and relatively longer. The Leavenworth specimens I find are, in respect to color, about half way between the Fort Hays type and the common form of the Eastern States.

DIRECTIONS FOR COLLECTING MICROLEPIDOPTERA.

BY LORD WALSINGHAM.

Having been asked to give a few directions for collecting Microlepidoptera, I think I can best do so by describing as shortly as possible my own mode of proceeding, adding such hints as may occur to me.

I go out with a coat provided with large pockets inside and out, containing an assortment of pill boxes generally of three sizes, glass bottomed pill boxes preferred, a bag slung over my shoulder, and a net. Unless searching for particular day flying species I prefer the last three hours before dark. As the sun goes down many species move which do not stir at other times. I watch the tops of the grass, the stems of the flowers, the twigs of the trees; I disturb leaves and low growing plants with a short switch and secure each little moth that moves, taking each out of the net in a separate pill box, selected according to the size of the insect, as he runs up the net to escape. Transferring the full boxes to the bag I continue the process until moths cease flying or night sets in. Many species can be taken with a lamp after dark.

Returning to camp I put a few drops of liquid ammonia on a small piece of sponge and place it in a tin canister with such of the boxes as do not contain the smallest species, and put these and the remainder away until morning in a cool place. In the morning I prepare for work by getting out a pair of scissors, a pair of forceps, my drying box containing setting boards, a sheet of white paper and some pins.

First, I cut two or three narrow pieces of paper from three to six lines wide, or rather wider, according to the size of the largest and smallest specimens I have to set. I then double each of these strips and cut it up into braces by a number of oblique cuts. Now I turn out the contents of the canister and damp the sponge with a few drops of fresh ammonia, refilling with boxes containing live insects. Those which have been taken out will be found to be all dead and in a beautifully relaxed condition for setting. Had the smallest specimens been placed in the canister over night, there would have been some fear of their drying up, owing to the small amount of moisture in their bodies.

If the weather is very hot there is some danger of killed insects becoming stiff while others are being set, in which case it is better at once to pin into a damp cork box all that have been taken out of the canister, but under ordinary circumstances I prefer to pin them one by one as I set them.

Taking the lid off a box, and taking the box between the finger and thumb of the right hand, I roll out the insect on the top of the left thumb, supporting it with the top of the fore finger and so manipulating it as to bring the head pointing towards my right

hand and the thorax uppermost. Now I take a pin in the right hand and resting the first joint of the middle finger of the right against the projecting point of the middle finger of the left hand to avoid unsteadiness, I pin the insect obliquely through the thickest part of the thorax so that the head of the pin leans very slightly forward over the head of the insect. After pressing the pin far enough through to bring about one-fourth of an inch out below, I pin the insect into the middle of the groove of a setting board so that the edge of the groove will just support the undersides of the wings close up to the body when they are raised upon it. The board should be chosen of such a size as will permit of the extension of the wings nearly to its outer edge. The position of the pin should still be slanting a little forward. The wings should now be raised into the position in which they are intended to rest, with especial care in doing so not to remove any scales from the surface or cilia of the wings. Each wing should be fastened with a brace long enough to extend across both, the braces being pinned at the thick end, so that the head of the pin slopes away from the point of the brace; this causes the braces to press more firmly down on the wing when fixed. The insect should be braced thus: the two braces next the body should have the points upwards, the two outer ones pointing downwards and slightly inwards towards the body, and covering the main portion of the wings beyond the middle. Antennæ should be carefully laid back above the wings, and braces should lie flat, exercising an even pressure at all points of their surface. The fore wings should slope slightly forwards so that a line drawn from the point of one to the point of the other will just miss the head and palpi. The hind wings should be close up, leaving no intervening space but just showing the upper angle of the wing evenly on each side. I can give no more precise directions as to how this desirable result may most simply and speedily be attained; no two people set alike. Speed is an object; for I have often had to set twelve dozen insects before breakfast. A simple process is essential, for a man who is always pinning and moving pins, and rearranging wings and legs, is sure to remove a certain number of scales and spoil the appearance of the insect besides utterly destroying its value. I raise each of the fore wings with a pin and fix the pin against the inner margin so as to keep them in position while I apply the braces. Half the battle is really in the pinning. When an insect is

pinned through the exact centre of the thorax, with the pin properly sloped forward, the body appears to fall naturally into its position on the setting board, and the muscles of the wings being left free are easily directed and secured; but if the pin is not put exactly in the middle, it interferes with the play of the wings. Legs must be placed close against the body or they will project and interfere with the set of the wings. Practice, care and a steady hand will succeed. When all the insects that have been killed are set, the contents of the canister will be found again ready, twenty minutes being amply sufficient to expose to the fumes of ammonia. Very bright green, or pale pink insects should be killed by some other process, say chloroform, as ammonia will affect their colors.

Insects should be left on the setting boards a full week to dry, then the braces may be carefully removed and they may be transferred to the store box.

Having given some account of the process each insect goes through I will say a word as to the apparatus required.

First as to nets. The simplest net is a strong, circular, iron wire hoop with bag of book muslin attached, fastened into a light deal or other handle.

I use a small pocket net about 9 inches in diameter made to fold up, with a jointed wire frame and a screw to fit into a brass socket in a short cane handle. To counteract the strain of the net upon so slight a frame the three wire joints are made flat, the two side joints flattened across the strain, the upper one the reverse way; but to prevent this upper joint from coming into play when the net is fixed, the upper part of the screw which holds the frame to the handle is welded square and fits a corresponding square socket in the other end of the wire frame, holding all tight when screwed down. A small green silk or other net can be slipped on or off this frame as required.

An umbrella net with stout steel rim and canvas edging is useful for sweeping tall grass and herbage, or to beat branches into, by which means many small and beautiful species of retired habits may be obtained.

I use pill boxes with glass bottoms, which can be obtained of various sizes. They are convenient in admitting of the examination of each specimen, so rare species can be especially searched for, and damaged ones permitted to escape; but they are expensive and for

ordinary purposes cardboard boxes answer sufficiently well. It is a good plan at the beginning of a season to strengthen all your boxes by a crossed strap of tape or calico firmly glued at the top and bottom. For a killing box any tin box or canister with a closely fitting lid capable of containing one hundred pill boxes will be found to answer.

Setting boards can be bought ready made of the smallest sizes. They are made by gluing a strip of thick cork on a thin slip of deal, the cork must be thick enough to enable a groove to be cut into it, deep enough to hold the bodies of the insects to be set and to leave sufficient depth for the pin to hold firmly without reaching the deal. The cork on each side of the groove should be smoothed off with a gentle curve, so that the wings dry in a good position. The deal backing projects beyond the cork so as to slide into a groove if required, and it is convenient to have a deal cupboard of drying boxes with handle at top and perforated zinc door, having grooves on each side into which the setting boards can be slid. Each board should be papered with thin white paper.

At the beginning of a season setting boards may be washed or brushed over with advantage with a weak solution of oxide of zinc, it fills up old pinholes and makes them look clean.

For *Tortricina* use No. 10 pins; for *Tineina* (small), No. 19; for *Nepticulæ*, No. 20.

Always set your insects as soon as you kill them, they are then much more easy to set and retain their position better when dry.

When pill boxes are filled keep them cool to prevent the insects from fluttering; if glass boxes, keep them also in the dark.

Many species when first taken will flutter in the boxes and injure themselves; for these it is well when collecting to carry a small phial of chloroform and a zinc collecting box corklined, into which you can at once pin your captures; the cork should be damped to keep them fresh. Touching a pill box with a finger moistened with chloroform will kill the insect inside. Too much chloroform is apt to stiffen the nerves of the wings and interfere with setting.

By breeding Microlepidoptera many species not otherwise easily obtainable may be added to a collection, and the habits of others in the larva state may be studied with much interest. For this purpose a few wide mouthed glass bottles should be obtained with corks to fit, so that the small larvæ can be placed in them with fresh food and the food kept fresh by exclusion of air. If

mould should appear the cork can be replaced by muslin or net tied over. I would hardly advise a travelling collector to attempt this method although I have adopted it with some success, but in a stationary camp it is most interesting and comparatively easy.

Corklined store boxes are of course required into which to remove the insects when sufficiently dried on the setting boards. These, as well as the pins and setting boards with drying case to hold them, and the net frames of the folding and umbrella patterns will best be obtained from some dealer in such things.*

To pack Microlepidoptera for travelling, pin them firmly close together into a corklined box, so that each specimen just gently holds down the body of the one above it. This cannot be done with very minute species. Put your box into another larger box and let the outer one be sufficiently large to leave a good clear six inches all round the inner one. Pack this intervening space with hay not crammed too tight; it will act as a spring and reduce the effect of shaking; the whole parcel should be made thoroughly secure against damp.

In conclusion I would say that I shall be happy to receive specimens from collectors in all parts of the world and will willingly send European species in exchange where this is desired; or if preferred I will pay at the rate of, say four cents each, for all specimens sent in good condition. I shall also be happy to answer all communications upon the subject and to send a small box containing two or three specimens as types to show how insects ought to be set, to any one who proposes to send me specimens. Moreover should any collector send me insects in good condition I will willingly supply him with a full outfit of setting boards and pins and a store box to encourage further collections.†

Insects in a damaged condition are not of the slightest value to me in any way.

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* In London there are several, among whom I would mention T. Cook, New Oxford Street, and Thomas Eedle, Maidstone Place, Hackney Row. The manufacturers of entomological pins, which can, however, be obtained from the above dealers, are Messrs. Eddleston & Williams, Birmingham; Messrs. Kirby & Beard, Canon Street, London. In America, The Naturalists' Agency, Salem, Mass., and C. G. Brewster & Co., Washington St., Boston, keep on hand insect pins, cork, pill boxes, and most of the other articles required by the collector.

† Address, The Lord Walsingham, Merton Hall, Thetford, England.

INSTRUCTIONS FOR PREPARING BIRDS' EGGS.

BY WILLIAM WOOD, M.D.

I WISH to say a few words for the benefit of those engaged in collecting oölogical specimens.

Twenty years ago, all eggs were blown with two holes—one at each end, and until within ten years most eggs have been emptied with two holes as above, or at the side. Very many of the eggs which I now receive in my exchanges are similarly prepared. At the present time no experienced collector ever makes but one hole to remove the contents of the egg, using a blowpipe in some form to accomplish this object. The following rules should invariably be followed.

1st. Prepare your eggs neat and clean. There is no excuse for having a dirty set of eggs where water, soap, and a tooth brush can be found. Some eggs will not bear washing, as the shell is so calcareous that the characteristic markings will wash away. There are, however, but few of this class, and I believe this peculiarity is confined to the water-birds. You can see it in any of the species (Smithsonian Catalogue) from 615 to 628 inclusive, and also in the eggs of the Grebes and Flamingo, and some others. Having once seen it you will never mistake it for anything else.

2d. Make but one hole, and that a small one in the middle of the egg—cover this hole, when the contents are removed and the specimen is dry, with gold-beater skin or the paper number indicating the bird. Use an egg drill or a pointed wire of four or six sides to make the opening.

3d. If the blowpipe does not readily remove the contents of the egg, inject water and shake the specimen thoroughly, then blow again, and repeat the operation until every particle of the egg is removed.

4th. If the embryo is too far advanced to remove through a moderate sized hole, blow out what you can of the liquid part and fill the egg with water, wipe it dry and put it away in a covered box in some warm place, and every 24 or 48 hours shake it well and remove what you can, and then refill with water. Repeat this

operation several times, and after a few days the contents will become sufficiently decomposed to take away.

5th. After removing the contents of any egg cleanse the shell thoroughly. Fill it with clean water and shake vigorously, blow out the contents and repeat the operation until the specimen is perfectly clean. This is particularly desirable in white eggs, as black spots will show through the shell after a time if the least particle of the egg or blood stains remains inside.

6th. Save all your eggs in sets—that is, keep all the eggs each bird lays by themselves. This is the only way to form a correct knowledge of the eggs of any species, as a single egg, particularly of the blotched ones, frequently gives a very erroneous idea of the general markings—a very unsatisfactory representative of a set. For instance, in my collection are four eggs of the *Buteo lineatus*, found in the same nest, two of which are pure white and two blotched. It is not very uncommon to find great variations in markings in the same species and in the same nest.

7th. Keep a memorandum of the place and date of collecting each set of eggs.

8th. Use some kind of a blowpipe in preparing your eggs for the cabinet. The common blowpipe, with the addition of a fine pointed tip, will answer; yet it is a severe tax on the lungs and brain if you have many eggs to blow. I have many a time been dizzy and almost blind from overtaxing my lungs in this operation. Within a few years Mr. E. W. Ellsworth, of East Windsor Hill, Conn., has invented a blowpipe which is operated by the thumb and finger, which works very perfectly and expeditiously. I would not be without it on any account. After using it for a time, and then letting it remain unused until the leather packing becomes dry, the instrument does not work satisfactorily to those unaccustomed to it. The remedy is simple. Take off the blowpipe and work the instrument submerged in a bowl of warm soap suds, when the leather packing becomes pliable and works as well as new. I have used the same instrument six years, and it works to-day as well as when new by following the above directions. The printed directions which accompany each instrument are intended to be a sufficient guide in case repairs are needed, and the maker can be referred to for any further information required.

RELATIONSHIP OF THE AMERICAN WHITE-FRONTED OWL.

BY ROBERT RIDGWAY.

I WISH to call the attention of ornithologists to a paper recently published in the London "Ibis" (vol. ii, January, 1872), upon the relationship of the North American White-fronted Owl, known as "*Nyctale albifrons* Shaw," or "*N. Kirtlandii* Hoy." The author of the paper in question, Mr. D. G. Elliot, refers that bird to the *N. Tengmalmi* Gmel., of Europe, with which species he also considers our *N. Richardsoni* Bonap., to be identical. That both these opinions are erroneous, I purpose showing in the following remarks:

The little owl above mentioned, is a bird identical in all the details of form and size with the *N. Acadica* Gmel., an exclusively North American form, which is scarcely more than half the size of the *N. Tengmalmi*, and cannot, by any means, be referred to the latter species. The birds which Mr. Elliot supposes to be identical with "*N. albifrons*" are merely the young of *N. Tengmalmi*, in a plumage analogous to that of the small North American species, but resembling the latter no further. Mr. Elliot is by no means the first to notice this plumage, for it has been long known to European ornithologists, and its relations correctly understood (see Naumann "Die Vögel Deutschlands," i, p. 500, pl. 48, figs. 2 and 3—where both the adult and young plumages are illustrated). Neither do I claim to be the first to refer the "*N. albifrons*" to the *N. Acadica*, as being its young stage, for Strickland in "Ornithological Synonymes" (i, 1855, p. 177) places the two together.

Being aware of the differences between the adult and young plumages of the *N. Tengmalmi*, and seeing a direct analogy in the characters of the *N. Acadica* and "*N. albifrons*" I suspected a similar relation between these two small North American forms; and in the course of my investigations of the North American Strigidæ in the collection of the Smithsonian Institution I found other reasons for considering them old and young of one species. These reasons I present as follows:—

1st. All specimens examined, of *N. albifrons* (including Hoy's

type of *N. Kirtlandii*) *are young birds*, as is unmistakably apparent from the texture of the plumage.

2nd. All specimens examined of the *N. Acadica*, are *adults;* I have seen no description of the young.

3rd. The geographical distribution, the size and proportions, the pattern of coloration (except that of the head and body, which in all owls is more or less different in the young and adult stages) and the shades of color on the general upper plumage, are the same in both. The white "scalloping" on the outer web of the alula, the number of white spots on the primaries and the precise number and position of the white bars on the tail, are features common to the two.

4th. The most extreme example of "*albifrons*" has the facial circle uniform brown, like the neck, has no spots on the forehead, and the face is entirely uniform dark brown; but—

5th. Three out of the four specimens in the collection have the facial circle composed of white and brown streaks (*adult feathers*) precisely as in *Acadica*, and the forehead similarly streaked (*with adult feathers*). Two of these have new feathers appearing upon the sides of the breast (beneath the brown patch), as well as upon the face; *these new feathers are, in the most minute respects, like* common (adult) dress of *N. Acadica.*

The above facts point conclusively to the identity of the *Nyctale* "*albifrons*" and *N. Acadica.* This species is easily distinguishable from the *N. Tengmalmi* which belongs to both continents, though the North American and European specimens are distinguishable, and, therefore, should be recognized as geographical races.

I give below a brief synopsis of the two species, and the principal list of synonymes belonging to each:—

DIFFERENTIAL CHARACTERS OF NYCTALE.

Tengmalmi and *Acadica.*

COMMON CHARACTERS.—Tarsus longer than middle toe; tail slightly rounded, or nearly square: five outer primaries emarginated on inner webs, their ends broad and bowed; 3d quill longest. Upper parts generally chocolate-brown, more or less spotted with white, the tail having distant transverse narrow bars of the same. *Adult:* Facial circle and forehead variegated with white; eyebrows and face grayish white; lower parts white with longitudinal spots, or stripes, of chocolate brown. *Young:* Facial circle and forehead plain blackish brown; eyebrows pure unvariegated, white; face plain dusky; lower parts without markings; the breast plain chocolate brown; the abdomen, etc., plain ochraceous.

A.—Nostril sunken, opening laterally; elongate oval, and obliquely vertical. Cere not inflated. Tail more than half the wing. Bill yellow.

1. N. TENGMALMI. — Wing about 7.20; tail 4.50.

a. Legs white, scarcely variegated; lower tail coverts with only narrow shaft streaks of brown. (Maximum amount of white, the spots of this color much extended, on the scapulars even largely predominating over the brown.) *Hab.* The Palæarctic Region (Europe, Siberia and Northern Africa.) . . . . Var. *Tengmalmi.**

b. Legs ochraceous, thickly spotted; lower tail coverts with broad medial stripes of brown. (Minimum amount of white, and excess of darker colors; the latter not only deeper in tint, but occupying larger areas. The difference readily appreciable on comparison.) *Hab.* Northern portion of the Nearctic Region (Arctic America south to the northern border of the U. S.). . . . . Var. *Richardsoni.*†

B.—Nostril prominent, opening anteriorly; nearly circular. Cere somewhat inflated. Tail not more than half the wing (rather less). Bill black.

2. N. ACADICA.‡—Wing 5.25 to 5.80; tail 2.60.—*Hab.* Cold temperate portions of Nearctic Region (Southern British America and Northern U. S. from the Atlantic to the Pacific on the mountain ranges, southward nearly to the southern borders of the U. S., and into Mts. of Mexico. Oaxaca, *Scl.* P. Z. S. 1858, 295).

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* NYCTALE TENGMALMI.

Strix Tengmalmi GMEL., S. N. p. 291, 1789 (et Auct. var.).—*Nyctale Tengmalmi* BONAP. et Auct.—*Noctua Tengmalmi* CUV., et Auct.—*Athene Tengmalmi* BOIE.—*Ulula Tengmalmi* BONAP. et Auct.—*Scotophilus Tengmalmi* SWAINS.—*Strix dasypus* BECHST. (1791) et Auct.—*Nyctale dasypus* GRAY.—*Strix passerina* A. MEYER (1794).—PALLAS.—*Nyctale planiceps* BREHM (1831).—*Nyctale pinetorum* BREHM (1831).—*Nyctale abietum* BREHM (1831).—*Nyctale funerea* BONAP. (1842). (Not of LINN., 1761, which is *Surnia ulula.*)—*Nyctale Kirtlandi* ELLIOT, Ibis, II, Jan., 1872, p. 48. (Not of HOY!)

† NYCTALE TENGMALMI var. RICHARDSONI.

Nyctale Richardsonii BONAP. Eur. and N. Am. B., p. 7; 1838, et Auct.

‡ NYCTALE ACADICA.

Strix Acadica GMEL. Syst. Nat. p. 296, 1789.—DAUD. N. Orn., II, 206, 1800.—VIEILL. Ois. Am. Sept., I, 49, 1807.—AUD. B. Am. pl. 199, 1831; Orn. Biog. V, 397.—RICH. and SWAINS., F. B. A., II, 97, 1831.—BONAP. Ann. Lyc. N. Y., II, pp. 38, 436; Isis, 1832, p. 1140.—JARD. (Wils.) Am. Orn. II, 66.—NAUM. Nat. Vog. Deutschl. ed. nov. I, 434, pl. 43, figs. 1 and 2.—PEAB. B. Mass., p. 90.—NUTT. Man. p. 137, 1833.—*Nyctale Acadica* BONAP. List. p. 7, 1838; Consp. Av. p. 44.—GRAY, Gen. B. fol. App. p. 3. 1844.—KAUP. Monog. Strig. Cont. Orn. 1852, p. 104.—STRICKL. Orn. Syn. I, 176, 1855.—NEWB. P. R. R. Rept. VI, 77, 1857.—CASS. B. N. Am. 1858, 58.—COOP. & SUCK. P. R. R. Rept. XII, ii, 156. 1860.—COUES Prod. B. Ariz. 14, 1866.—GRAY Hand List I, 1869, 51.—LORD Pr. R. A. I, IV, 111 (Brit. Columb.).—*Scotophilus Acadicus* SWAINS. Clasif. B. II, 217, 1837.—*Strix passerina* PENN. Arct. Zool. p. 236, sp. 126, 1785.—FORST., Phil. Trans. LXII, 385.—WILS. Am. Orn. pl. 34, f. 1, 1808. *Ulula passerina* JAMES. (Wils.) Am. Orn. I, 109, 1831.—*Strix Acadiensis* LATH. Ind. Orn. p. 65, 1790.—*Strix albifrons* SHAW. Nat. Misc. V, pl. 171, 1794: Zool. VII, 238, 1809.—LATH. Orn. Supp. p. 14.—*Bubo albifrons* VIEILL. Ois. Am. Sept. I, 54, 1807.—*Scops albifrons* STEPH. Zool. XIII, ii, 51.—*Nyctale albifrons* CASS. B. Cal. & Tex. 187, 1854.—BONAP. Consp. Av. p. 54.—CASS. Birds N. Am. 1858, 57.—*Strix frontalis* LICHT. Ath. Ak. Berl. 1838, 430.—GRAY Hand List 1, 52, 1869.—*Nyctale Kirtlandii* HOY, Proc. Ac. Nat. Sc. Phil. VI, 210; 1852.—*S. phalænoides* DAUD. Tr. Orn. II, 206, 1800.—LATH. Ind. Orn. Supp. p. 16, 1802; Syn. Supp. II, 66, Gen. Hist. I, 372, 1828.—*Athene phalænoides* GRAY. Gen. B. fol. sp. 43, 1844.—*Athene Wilsoni* BRIE, Isis, 1828, 315.

ONE OF OUR COMMON MONADS.

BY PROF. ALBERT H. TUTTLE.*

SINCE the investigations of Clark, Carter and others upon the sponges and their allies, anything which adds to our knowledge of the Flagellate Infusoria is of especial interest. I have fortunately had an opportunity of making a careful study of a genus *Urella* of Ehrenberg, about which thus far but little that is satisfactory has been known.

Until recently but little has been known of the real nature of the Monadina. As a natural consequence, organisms have been referred to the different genera of this family upon very slight study and superficial resemblances. Urella, which Ehrenberg describes thus, "aggregate monads, free-swimming, tailless, devoid of an eyespeck and having one or (doubtfully) two flagelliform filaments," has of course received its share of attention until one might think from the "species" and the figures given that the diagnosis of the genus had been "anything very minute, aggregated, free-swimming," — whether Infusorian or Alga making no difference.

Fig. 86.

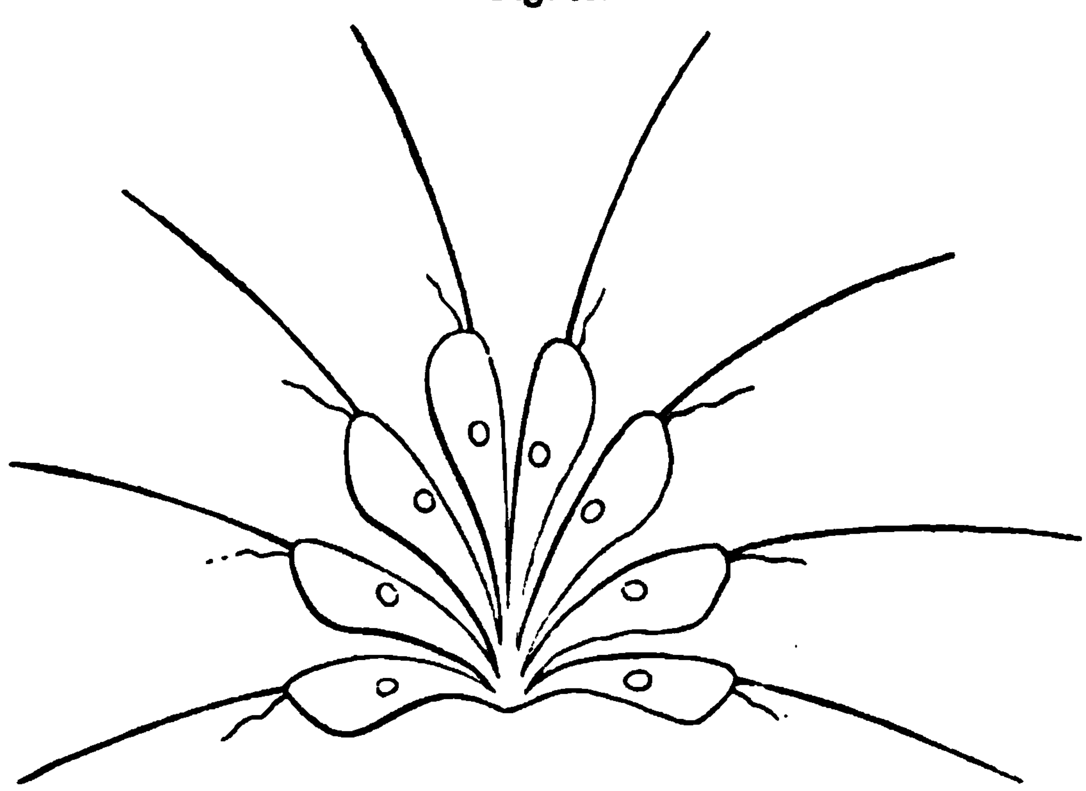
A colony of about forty Monads.

When, therefore, I found in a collection made at Spy Pond, near Cambridge, on the 25th of November last, a large number of individuals of this genus (probably the species *glauconia* Ehr.), I made use of the opportunity for a careful study of it, devoting my spare time to it daily as long as I continued to find it in the water; what follows is therefore the result of a number of observations, at which each point has been examined and verified.

*Communicated to the Section of Microscopy of the Boston Society of Natural History, Dec. 13th, 1871.

Urella probably finds its nearest ally in Anthophysa, differing from that genus principally in being free-swimming instead of fixed upon a stalk. The number of monads in a colony is quite variable, almost every number having been seen, up to forty or fifty; in this, however, as in many other respects, the constant activity of the colonies renders it impossible to speak with absolute certainty; even when cornered so that they could no longer progress in the direction in which they had been moving, they continued to revolve upon their axes with considerable rapidity, making it impossible to count them with accuracy. Occasionally, a group of five or six or even two or three and not unfrequently a

Fig. 89.



An ideal section through a colony of Monads.

single monad would be seen, and these were more available for purposes of study, though the larger groups were more frequent.

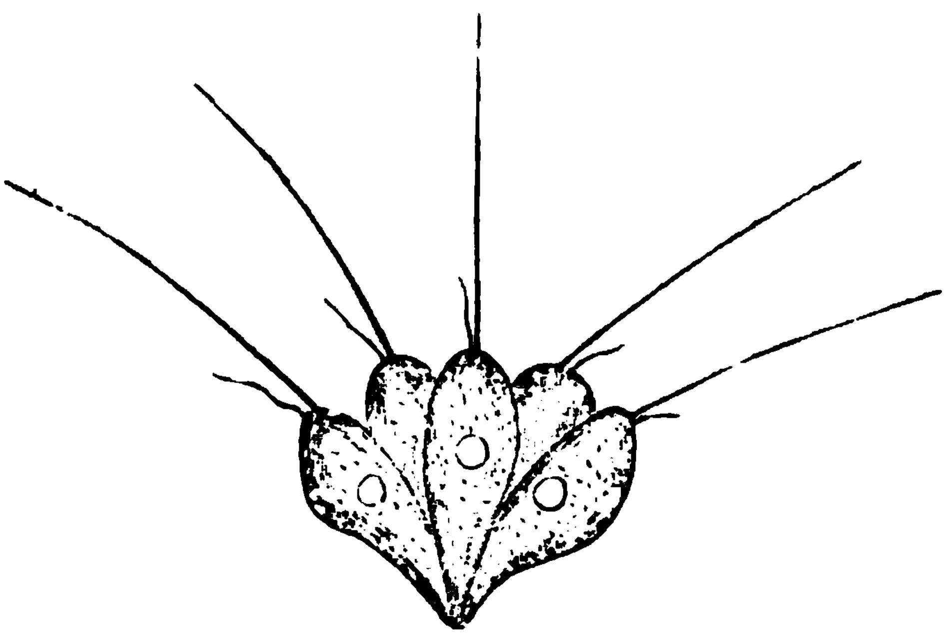
From such measurements as I was able to make while they were in motion, I should say that the average length of each monad was about one two-thousandth and the breadth one five-thousandth of an inch; but these dimensions varied a good deal with the size of the colonies, the individuals in the larger groups being more elongated and narrower than those in the smaller ones. The form may be described as conical with a rounded base not at right angles with the axis of the cone, the part at the greatest distance from the apex being the one nearest the apex of the colony; in colonies of over ten or twelve the axis of the cone being also bent towards the apex of the group, especially in those monads near the base. The form of the larger colonies varied from hemispher-

ical to raspberry or even mulberry shape, the form shown in Fig. 88 being the most common.

I was unable to find any trace of a common investing membrane in either the larger or the smaller groups, nor do I believe that any such membrane exists in any true species of Urella.

I was able to distinguish clearly *two* flagella, both arising from a point near the most elevated side of the base of the cone. The larger one was stiff, arcuate with the concave side toward the base before mentioned, somewhat longer than the body of the monad, and very plainly seen with any objective above a quarter-inch; the smaller is very delicate, short and incessantly act ve. I first saw it with a Wales' fifteenth, but after becoming familiar with its appearance I was always able to detect it with a Tolles' eighth or a Hartnack number nine.

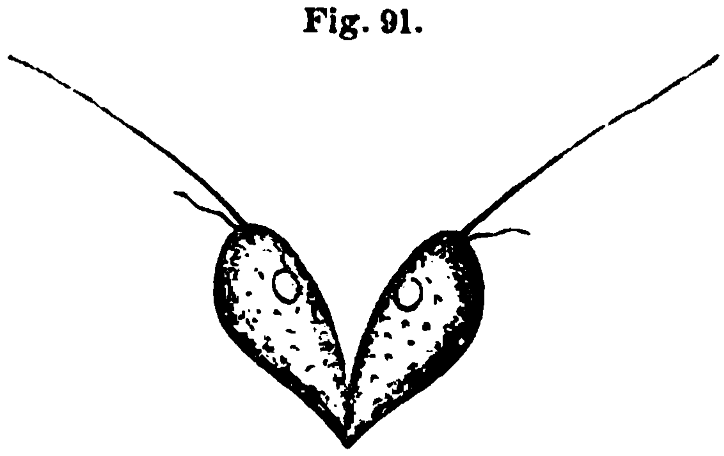
Fig. 90.



A group of five Monads.

I am not certain as to the number of contractile vesicles but it is my opinion that there is but one: sometimes a larger number of clear spaces would be seen in the body, but they were not observed to contract. I do not wish, however, to speak with any degree of positiveness upon this point, as I was not able to keep a single monad in view long enough to satisfy myself, on account of the constant revolution of the colonies. As regards the ingestion of food I have seen something, though not as much as I could wish, as this is still a disputed question. I fed them with indigo which they ate readily, and I frequently watched its ingestion. On account of their incessant motion, I was not able to satisfy myself of the existence of a definite mouth, but I did not see a single instance of the indigo being received at any point except very near the com-

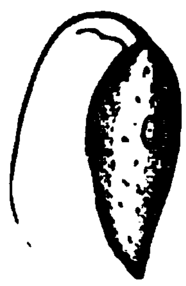
Fig. 91.



Two Monads.

mon base of the flagello, and in every instance observed, the act of ingestion was preceded by a quick bending of the larger flagellum by which the particle of indigo was thrown against the surface of the body in a manner similar to that described by Professor Clark in his observations upon Monas. So far as I was able to follow the process, whenever a colony reduced its rate of motion sufficiently to permit of careful observation upon this point, it was so much like the process described in Monas as to leave little doubt in my mind that it was substantially the same: although as I have said I did not *see* a distinct mouth.

Fig. 92.



A Single Monad.

It appears probable, now that the Monadina are better understood, that we shall soon be able to recognize in them a well-defined family of the Flagellate Infusoria, although doubtless many forms that have been assigned to that group are vegetable in their nature; these will be gradually removed and those forms which are unquestionably animal will be distinguished: among these it seems to me the genus Urella as described by Ehrenberg will undoubtedly take its place.

Figure 88 represents a colony of about forty monads; Fig. 89 an ideal section through such a colony; Fig. 90 represents a group of five; Fig. 91 of two, and Fig. 92 a single monad. I have attempted to sketch in this last the position of the large flagellum when throwing a particle of food against the mouth region.

All the above figures are enlarged one thousand diameters.

REVIEWS AND BOOK NOTICES.

Geological Survey of Ohio.*—Though this is but a yearly report of progress, yet it is an important contribution to American geology, both in its purely scientific and practical aspects. We are convinced that when the final reports shall be published, the citizens of the State of Ohio will feel proud of the thorough and able manner in which the survey has been carried on and com-

*Report of Progress in 1870. By J. S. Newberry, Chief Geologist. Including Reports by E. B. Andrews, Edward Orton, J. H. Klippart, Assistant Geologists; T. G. Wormley, Chemist; G. K. Gilbert, M. C. Read, W. B. Potter and Henry Newton, Local Assistants. 8vo, pp. 568, with maps and engravings.

pleted, and of the monument to scientific zeal and learning erected in the series of magnificent works which we are promised in the present report. We make a few extracts regarding the discoveries made by the survey. The fossil invertebrates are to be worked up by Profs. Hall and Worthen, many novelties having been found.

"The interesting collection of Amphibian remains, which includes more than a dozen species, obtained by myself some years ago from the coal rocks of Ohio, has been placed in the hands of Prof. E. D. Cope, of Philadelphia. He has described them and caused them to be carefully drawn. They supply material for six or more plates, which will add much to the interest of our final report.

The fossil fishes and fossil plants found in the State have been described by myself. They have been drawn by Mr. T. Y. Gardner and Mr. G. K. Gilbert in a style that has not been surpassed in this country, and some of their work is equal to any of a similar character done by the best European draughtsmen. The illustrations already prepared of this material form over forty plates; and I do not hesitate to say that the objects which they represent are not exceeded in scientific interest by any that have been described by palæontologists. The fossil fishes comprise many genera and species, some of which are more remarkable for their size, their formidable armament or peculiarities of structure than any of those which formed the themes of Hugh Miller's glowing descriptions. These have, for the most part, been found only in Ohio; have never been described and will not fail to deeply interest all the intelligent portion of our population.

In my first report of progress (p. 5) I have shown how useful, even indispensable, fossils are to the student of geology, and I am happy to know that their significance and value are coming to be generally appreciated. There are, however, yet some intelligent men, even editors and members of the legislature, who cherish the notion that there is nothing which has any value in this world but that thing which has a dollar in it, and that so plainly visible as to be seen by them. Such men, to quote the language of one of them, 'don't care a row of pins for your clams and salamanders, but want something practical.' Happily the class to which they belong is rapidly passing away. Were it otherwise I should endeavor to prove to them that the fossils which they despise *are* eminently practical; that they are labels written by the Creator on all the fossiliferous rocks, and that no one can be a geologist who has not learned their language."

We are promised that the final reports will consist of four volumes, of which the first two will be on Geology and Palæontology with a geological map on a large scale, vol. 3 on Economic Geology and vol. 4 on Agriculture, Botany and Zoology.

In his "Sketch of the Structure of the Lower Coal Measures in Northeastern Ohio," Prof. Newberry says that:—

"It is worth noticing, in this connection, that the Killbuck and Tuscarawas run in parallel synclinal valleys, and it seems probable that the folding of the strata which formed these subordinate troughs and ridges in our great coal basin first gave direction to the draining streams of the region we have been considering; and that, in a general way, these lines of drainage have retained, through all subsequent mutations the directions thus given them.

Our knowledge of the geology of our coal field is yet too incomplete to permit me to speak with confidence; but, from the facts already observed, I am prepared to find that the bearings of the valleys of the Ohio and all its main tributaries in our State have been determined by the same causes that produced the great folds of the Alleghany mountains.

Another interesting fact in regard to the valleys of the streams is, that they are all cut far below the present stream-beds. The valley of the Beaver is excavated to a depth of over 150 feet below the present water level. The trough of the Ohio is still deeper. The Tuscarawas, at Dover, is running 175 feet above its ancient bed. The rock bottom of the Killbuck valley has not yet been reached.

The borings made for oil along the streams of the region under consideration, as well as in other parts of the country, afford many remarkable facts bearing on this subject. They will be reported more in detail in the chapter on Surface Geology in our final report."

Prof. Andrews records an interesting discovery, as follows:

"At Zaleska, in mining the Nelsonville coal, a fine bowlder of gray quartzite was found half imbedded in the coal, and the other half in the overlying shale. The quartzite is very hard, and the bowlder was rounded and worn by friction before it came into the coal. The dimensions of the bowlder are not far from 17 inches in the longer diameter, and 12 inches in the shorter. Adhering to the stone in places are portions of coal and black slate which show the smooth surface called "slickensides." These indicate movement and pressure. Doubtless the bowlder had settled into the coal while the coal was in a comparatively soft state at the time of the bitumization.

How the bowlder came there, is a question not easily answered. That it came in at the time of the deposition of the sediments which constitute the shale over the coal, is doubtless true. But currents from which comparatively fine sediments are dropped, would hardly have force enough to move heavy bowlders. The usual explanation of isolated bowlders, such, for example, as are found over our prairies, is that they were dropped from melting icebergs or other floating ice. This explanation would require us

to account for the existence of ice during the period of the productive Coal-measures. A part of the vegetation of the coal period was allied more or less closely to the modern ferns, but these, of very large size are found chiefly in the tropics. Coal is, however, found in arctic regions. This fact has been supposed to indicate a warm climate during the coal period. There are two equally important elements in all calculations respecting the origin of coal. The first is a sufficiently warm atmosphere to secure luxuriant and abundant vegetation; the second, a climate sufficiently cool to prevent such decay of the vegetable matter as would forbid any accumulation. There is little or no accumulation of vegetable matter in the hot, damp climate of the tropics, the decay counterbalancing the growth. On the other hand, the peat vegetation accumulates in wet bogs in comparatively cold climates. Whether there may have been, after the submergence of the Zaleski coal, at some point more or less remote, a shore on which ice may have been formed, which floated the bowlder in question, or it was brought down by river ice from some higher and colder part of the old continent which was skirted by the coal producing lowlands, it is impossible to say.

Sir Charles Lyell in his "Students' Elements of Geology," published in 1871, gives the following paragraph on the climate of the coal period: 'As to the climate of the coal, the ferns and the coniferæ are, perhaps, the two classes of plants which may be most relied upon as leading to safe conclusions, as the genera are nearly allied to living types. All botanists admit that the abundance of ferns implies a moist atmosphere. But the coniferæ, says Hooker, are of a more doubtful import, as they are found in hot and dry and in cold and dry climates, in hot and moist and in cold and moist regions. In New Zealand the coniferæ attain their maximum in numbers constituting 1-62 part of all the flowering plants; whereas, in a wide district around the Cape of Good Hope they do not form 1-1600 of the phenogamic flora. Besides the conifers, many species of ferns flourish in New Zealand, some of them arborescent, together with many lycopodiums, so that a forest in that country may make a nearer approach to the Carboniferous vegetation than any other now existing on the globe.'"

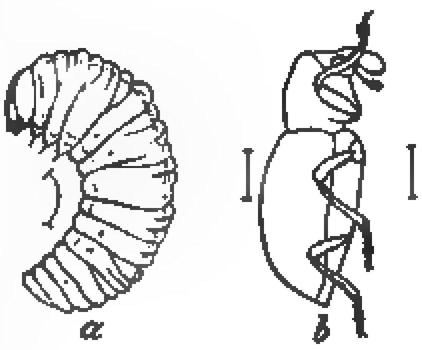
The other reports will also commend themselves to geologists, and meanwhile we trust no expense will be spared by the State in causing the final report to be published and extensively circulated.

THE NOXIOUS AND BENEFICIAL INSECTS OF MISSOURI.* — Though by the time this review appears we shall have a fourth report from Mr. Riley, a notice of some of the good things in the present re-

*Third Annual Report on the Noxious, Beneficial and other Insects of the State of Missouri, etc. By Charles V. Riley, State Entomologist. 1871. 8vo, pp. 182, with 73 cuts. Price $1.00.

port will perhaps be "better late than never." A description of the very ingenious machines for jarring trees to rid them of the Plum Curculio will be interesting to fruit growers; while two Ichneumon parasites of this insect are described and figured. The Apple Curculio (*Anthonomus 4-gibbus*) which is doing considerable damage in Southern Illinois and some parts of Missouri is described fully and well figured, as well as the Plum Gouger (*A. prunicida*). Another weevil injures the strawberry plant. It is the *Analcis fragariæ* of Riley (Fig. 93, *a*, larva; *b* and *c*, adult beetle). The egg is probably laid in the crown; the young larva boring downwards into the pith and root, when it attains its full size, and in the autumn the plants break off. The Pea and Bean weevils are noticed at length.

Fig. 93.



Strawberry Crown-borer.

Fig. 94.

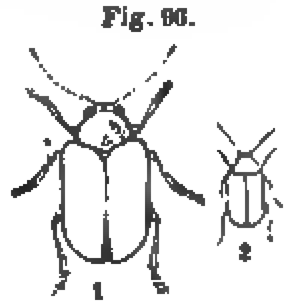
Amphipyra of the Grape.

Among the insects injuring the grape are noticed several moths; among them the Pyramidal Grapevine Worm (*Amphipyra pyramidoides*, Fig. 94; 95, larva), which has not before been known to feed on the vine. It will not probably prove very troublesome. The habits of the Spotted Pelidnota and Grapevine Flea Beetle are described and figured in an excellent manner. We are also made acquainted with the habits of a rather formidable beetle, clay yellow in color, the *Colaspis flavida* (Fig. 96; 97, larva) of which the early stages are for the first time described.

Fig. 95.

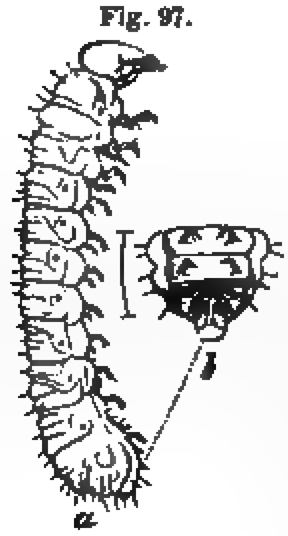
Larva of Amphipyra.

Fig. 96.



Grape Colaspis.

Fig. 97.



Larva of Grape Colaspis.

A valuable notice of the Grape-leaf Gall-louse (*Phylloxera vitifoliæ*) next follows, and we only hope that this fearful scourge in Europe will not abound here, though for several years it has been more or less injurious. It is thought by Mr. Riley, who has

Fig. 98.

White-lined Morning Sphinx.

studied it in France, to be the same species as the *P. vastatrix* of Europe.

The account of the Tent Caterpillars will be found to be interesting, and several other destructive caterpillars are noticed at greater or less length.

Fig. 99.

Larva of Morning Sphinx.

As a sample of the illustrations we introduce the above cuts of the White Lined Morning Sphinx (*Deilephila lineata*, Fig. 98) and its larva (Fig. 99). Riley alludes to the striking amount of larval variation in this species, having found on the same plant very light caterpillars, with black ones with a yellow dorsal line

and two rows of small yellow spots along the side. It is often attacked by Tachina flies.

The concluding chapter on "Two of our Common Butterflies (*Danais archippus* and *Limenitis disippus*); their natural history, with some general remarks on Transformation and Protective Imitation as illustrated by them," will interest all naturalists, especially those who have studied cases of mimicry.

Pond Life.*—There is not much to be said about this exquisite little book; the best thing to do about it is to read it. As its title states, it is a new edition of a familiar work by the present able Secretary of the "Royal Microscopical Society." Its authorship would be a sufficient guarantee of its scientific accuracy, but not of its general excellence in other respects; for few men, whether eminent or not, could prepare a volume containing so much to commend and so little to regret.

With the exception of an initial chapter devoted to the apparatus employed, the book is a Natural History work, describing and commenting upon the minute living forms which abound in the ponds near London. Usually a chapter is given to the work of each month in the year; and an interesting discussion of relations closes the list. The distribution of work through the various months would be more applicable to our Southern than to our Northern states, but the chief interest of the book is entirely independent of local considerations.

Written in a lively and dashing style, though without a touch of sensationism or vulgarity, illustrated with neat and life-like wood cuts and dainty colored prints, and presented by the publishers in an attractive form, this little gem of a book would be of as much interest to a poet or a philosopher as to a naturalist. We advise every intelligent reader, whether scientific or not, to buy the volume, and read it, and having read it to join with us in wishing that the author's next edition, or next work, may be as good if not as small.—R. H. W.

Deep Sea Corals.†—This elaborate treatise is on the deep-sea corals collected during the recent expeditions made for the

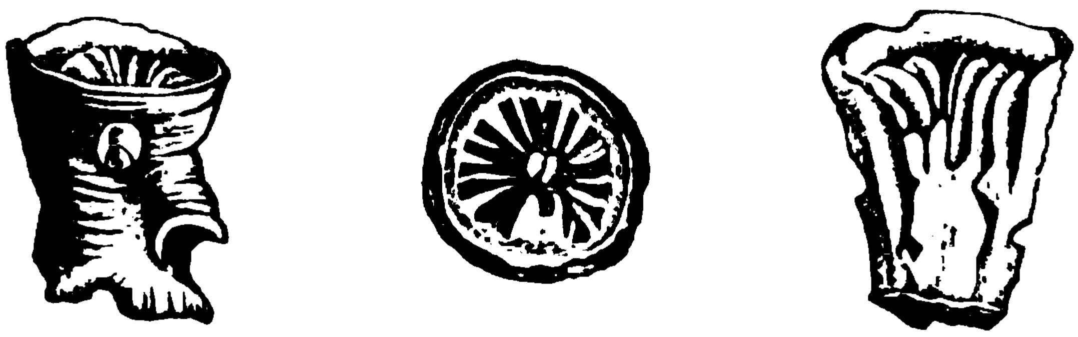
*Marvels of Pond Life. By Henry J. Slack, F. G. S. Second edition. London: Groombridge & Sons, 1871.

†Illustrated Catalogue of the Museum of Comparative Zoölogy. No. iv. Deep Sea Corals. By L. F. de Pourtalès. Cambridge, 1871, large 8vo, with a map and 8 lithographic plates.

exploration of the Gulf Stream, by the U. S. Coast Survey. The work contains much of general geological and zoological interest from the reviews of our present knowledge of the constitution of the sea bottom on the Atlantic coast of the United States, the results of which have already been presented to our readers.

Perhaps the most interesting of the corals figured is the *Haplophyllia paradoxa* dredged off Bahia Honda, at the enormous depth (for corals) of 324 fathoms. This remarkable form is referred by Count Pourtalès to the Rugose Corals, which have hitherto only been found in strata below the Coal measures, and therefore of great geological antiquity. The nearest allied form is *Calophyllum profundum*, found fossil in the Dyas. This coral is of such interest that we copy the figures. The brief remarks on

Fig. 100.



A Deep Sea Coral (*Haplophyllia*).

the geographical and bathymetrical distribution of the corals possess much interest. The reef building species do not seem to extend to any considerable depth. "The families having apparently the greatest range in depth, are the Oculinidæ, the Stylasteridæ, and the Melleporidæ. Simple corals, which form such a large proportion of the deep sea fauna, are not represented at all in the Floridian reef fauna; some species are described from the West Indies, but without indications of depth."

The author gives a list of dead corals, which have been swept north of their original habitat by the Gulf Stream. "The indications are that a current sweeps over the bottom in a direction from south to north; in other words, the Gulf Stream extends to the bottom, at least, as far north as the highest latitude mentioned, and is not underlaid by a cold Arctic current running in an opposite direction, as has sometimes been assumed to account for the low temperature at the bottom." The work concludes with notices of the corals constituting the Florida reef. The illustrations are abundant and excellent.

BOTANY.

Professor Babington on Anacharis. — The editors of the Naturalist will do a favor by reprinting Professor Babington's short article, contributed to the April number of the "Journal of Botany," in order that the attention of our botanists may be called to it during the coming summer. It may be that we have two water-weeds, as Babington and Planchon supposed; one diœcious, the other hermaphrodite. In that case the characters of the two are commixed in my manual. That plants with "hermaphrodite flowers really do exist in the United States" is certain. Dr. Torrey's "Flora of the State of New York" describes them, and I can vouch that the description was taken from living plants. He says "the stamens are mostly three, but varying to four, five or six, or more." As to the male flowers, of the peculiar structure and economy described by Nuttall, so far as I know these have been since collected only by Dr. Engelmann at St. Louis, who gave specimens both to Dr. Torrey and myself. Dr. Torrey states that he describes these specimens. It is to be hoped that Dr. Engelmann may be able to find this sterile-flowering plant again; and that all our botanists will examine the plants they meet with and preserve specimens of any different kinds or sexes of flowers they may detect.

Professor Babington appears to have overlooked Caspary's elaborate papers on these plants. As to the name, now that Adanson's genus is *Elodes*, there is nothing to prevent the restoration of *Elodea*.—A. Gray.

On Anacharis.—There is far from being a concurrence of opinion concerning the proper generic name of the plant called *Anacharis Alsinastrum*. In our last published Flora (Hook. Stud. Fl. p. 350) the name of *Anacharis* is used, as was done by Bab. and Planch. (Ann. Nat. Hist. ser. 2, vol. i. p. 83, and Ann. Sc. Nat. ser. 3, t. xi. p. 74); but in the next preceding British Flora (Benth. Handb. ed. 1, 499; ed. 2, 447) the generic name *Elodea* is adopted. Syme (Eng. Bot. ix. 80) follows Bentham, but in a note expresses the opinion that *Hydrilla* is the proper name. Asa Gray named the North American plant *Udora* in the first edition of his 'Botany of the Northern States' (p. 462), but in ed. 5 (p. 495) he has adopted *Anacharis* as the proper name.

Richard defined genera with each of the names *Elodea*, *Anacha-*

ris, and *Hydrilla* in 1812 (Mem. Inst. 1811, pt. 2, p. 1), and had previously described the genus *Elodea* in 1803 (Mich. Fl. Bor. Amer. i. 20). In the latter work he refers *E. guyanensis* to that genus, as well as E. *canadensis*, and places them as hermaphrodite plants in the Linnæan Class and Order *Triandria Monogynia*. In both of these places he states expressly that *Elodea* has hermaphrodite flowers. In the Mem. Inst. he says that *Anacharis* and *Hydrilla* are diœcious: indeed, he did not know the female flowers of *Anacharis*. Humboldt and Bonpland (Pl. Eqinoct. ii. 150) place their E. *granatensis* in the same Class and Order, and state that it has the same structure as E. *guyanensis* Rich. But Richard describes his E. *canadensis* as hermaphrodite, in which he is wrong, if his plant is that now so named from the United States and Canada; and his *E. guyanensis* and the *E. granatensis* of Humboldt as also hermaphrodite, and in that he is correct. It is remarkable that Richard, although referring to *E guyanensis* in Michaux's work in 1803 (but by name only), does not seem to have published any description of it until the appearance of his paper (Mem. Inst.), which was issued in 1814, but communicated to the Institute in 1812. Pursh called the Canadian plant *Serpicula occidentalis* in 1814 (El. Amer. Septen. i. 33), and expressly states that the flowers are hermaphrodite. Nuttall called the same plant *Udora* (Gen. ii. 242) in 1818. He describes the *U. canadensis* as so decidedly unisexual, that the male flower is "migratory, breaking off connection usually with the parent plant; it instantly expands to the light, the anthers also burst with elasticity, and the granular pollen vaguely floats upon the surface of the water." Asa Gray gives a similar account of the male flowers of his *Anacharis*. He says, "The staminate flowers (which are rarely seen) commonly break off, as in *Vallisneria*, and float on the surface, where they expand and shed their pollen around the stigmas of the fertile flowers."

It appears from this that there are two series of plants closely resembling each other in appearance, of which one series has perfect triandrous flowers, and the other has incomplete diœcious flowers, of which the males are nearly or quite sessile, and have the curious habit of becoming detached when the pollen is ripe, and floating freely about on the surface of the water, and shedding their pollen there. Such a difference of structure and mode of fertilization has seemed to many, if not most, botanists as quite sufficient to place the plants in different genera, for here the male are of quite a distinct structure from the female flowers, and the difficulty attending the propagation of the plant is met by the power which each node of the stem possesses of producing a new plant if detached from the rest.

But even if it be considered that the diœcious structure of *Anacharis* and *Hydrilla* is not sufficient to separate them from the hermaphrodite *Elodea* of South America (*Apalanthe*, Planch.), still

the expediency of retaining *Elodea* as the genuine name is very doubtful, as the sec. *Elodea* of *Hypericum* hasbeen separated as a genus by the name of *Elodea* by Pursh, Spach, Endlicher, and others, and as there was manifestly a mistake in Richard's original definition of his *Elodea* as applied to the species of *Anacharis* (if they were intended to be included in it), although that definition does suit the South American species described by him and by Humboldt. It appears, therefore, to me that we had better retain *Anacharis* as the name of the plant well known in North America, and, unfortunately, now too well known in England.

Doubtless Richard was led to suppose that the Canadian plant is hermaphrodite from its very close resemblance to his *E. guyanensis*, which he had seen alive and then ascertained its hermaphrodite structure. The barren filaments found in the female flowers of the Canadian plant would lead him to that conclusion in the absence of the proper male flowers. I have not seen the male flowers of my *Anacharis Alsinastrum* (of which apparently only the female plant is in Europe), and A. Gray does not tell us if they are sessile, as those of *Hydrilla* are represented on Richard's plate, or shortly stalked, as in his figure of *Anacharis*, and no other author has, to my knowledge, given a plate of the male plants of either *Hydrilla* or *Anacharis*.

Hydrilla seems quite distinct by the subglobose spathe of its sessile male flowers; the spathe of the male flowers of *Anacharis* being figured and described by Richard as tubular and bifid, and described by A. Gray as sessile, tubular, and 2-cleft. Richard also says that the male flowers of *Anacharis* are stalked and so figures them, but A. Gray does not say anything on that point.

Mr. Syme gives as his opinion that "there are no characters of sufficient importance to separate the genera *Hydrilla*, *Elodea*, and *Anacharis*," but in that opinion I cannot concur. Dr. Hooker states that the staminodes of the female flowers of *Anacharis* are sometimes antheriferous. I have examined very many flowers in the hope of finding anthers, but without success, and others have been equally unsuccessful. Hooker is apparently copying Syme, who derived (?) the statement from A. Gray, in whose book it seems to result from his considering *Elodea canadensis*, Michx., as certainly the same plant, and if the same plant as certainly correctly referred to the same genus as *E. guyanensis*, *i. e.* of hermaphrodite structure. It is much to be desired that American botanists should carefully investigate and determine if hermaphrodite flowers ever really do exist in the United States or Canada, for, apparently, it is of no use hunting for them in England, where all the plants seem to have sprung from the division of a single sprig originally introduced. Probably the plant found in Scotland, which is also female, originated in the same manner.

ANOTHER DOUBLE WILD FLOWER. In July of last year (1871)

while collecting in the region of perpetual snow on James' Peak, I found and preserved a flower of *Trollius laxus* in which the stamens and most of the pistils were transformed into petals. These petals were of the same color as the sepals, but shorter, though broad, and in other respects finely developed. The plant is abundant in the high mountains of this latitude.—Rev. E. L. Greene, *Greeley*, *Colorado Territory*.

ZOOLOGY.

The Last of "Bonasa Jobsii."—The immediate witnesses of the sudden appearance and prompt destruction of the above mentioned bird, greatly regret that a page of the Naturalist should be occupied in recording its career; but since this is the case (see issue of March, p. 172) and since some of the statements of your correspondent require correction, we hope that a final shot may be permitted; and first since neither the Naturalist nor its correspondent appears to have seen the following communication in which the describer of "Bonasa Jobsii" cheerfully resigned his first-born and since it contains some instructive remarks from high ornithological authorities, we request its insertion here.

"I beg the privilege of reading the views of two distinguished ornithologists, Professor S. F. Baird and Dr. Elliott Coues, upon the article published in The Era of December 8th, entitled "Bonasa Jobsii."

Professor Baird writes: 'Your letter of the 11th inst. with the accompanying description of the supposed new species of grouse has just been received, and after a careful examination of the account I have no hesitation in pronouncing your bird to be one of the numerous variations assumed by the common ruffed grouse. A difference in shape, or color of the plumage, or a discrepancy in an observed measure, or an anatomical peculiarity from a description based upon a dried specimen, is of comparatively little moment. The number of tail-feathers as a criterion is equally illusive, when the normal average of twelve is exceeded. When I published my work on the Birds of North America I was in what might be called the analytical stage of natural history development. My present condition is synthetical. I take more pains now to subordinate forms, once considered specific, than I do to establish them as such. I admit now but one species of *Bonasa* in the United States, with, however, an Eastern race, a Middle and a Western, these diversified by differences of plumage and slight variations of proportions which, however, are of no great

importance. A great difference in the colors of the Eastern bird has been frequently met with, and we have several specimens in our collection, answering very well to the account given of your bird.'

Dr. Coues, writing to the editors of THE ERA, says: 'The interest I take in ornithology is my excuse for begging enough of your valuable space to correct an unfortunate error that appears in your issue of December 8th. I say unfortunate, because the article in which a supposed new species of bird, *Bonasa Jobsii* is characterized, merely adds to the synonymy with which ornithology is overburdened. So far from conflicting with the genus *Bonasa*, or forming a new genus, the ruffed grouse that Mr. Jobs was unlucky enough to shoot, and Mr. Jaycox still more to write about, shows nothing of specific consequence. The number of rectrices of *Bonasa umbellus* varies from sixteen to twenty. (Vid., e. g., Bull. Mus. Comp. Zoöl., ii, 205.) The relative proportions of the tarso-metatarsus and medius-dactyl sometimes differ more than they appear to in this instance, while the discrepancies in color that are adduced by the writer are strictly within the range of individual variation.'

Thus we see Professor Baird and Dr. Coues agree that the bird described was a ruffed grouse.

There was one very important sentence omitted in the published article in THE ERA. It is: 'As I have no specimen of ruffed grouse I shall have to note the differences between the descriptions of such authors as I can consult and the bird in question.' The authorities I had the opportunity of studying were Baird's 'Birds of North America,' Wilson's 'American Ornithology,' Samuel's 'Birds of New England' and 'Observations of Wilson's American Ornithology;' in none of the above works could I find such a description of the ruffed grouse as would answer to the grouse in question. I could not find any remark which would lead one to think that the rectrices of the genus *Bonasa* were ever more or less than eighteen, and in reading Baird's 'Birds of North America' I found so many different species of birds differing from each other in so slight a degree that it led me to suppose the bird was one that had not been described.

In Professor Baird's letter he says: 'I admit now but one species of *Bonasa* in the United States.' At the time of the the publication of his work he describes two—*Bonasa umbellus* and *Bonasa Sabinii;* these he now believes to be the same bird, the difference being caused by geographical variation. Thus, by having a more complete knowledge of the different genera, he has changed his opinion in regard to the genus *Bonasa*. I do not doubt that, had Baird possessed the specimen I described, at the time he was writing 'Birds of North America,' he would have formed another genus for it; at least it would seem so from the manner in which he has made new species of specimens which

differ from each other in so few characteristics."—*From report of Proc. C. U. Nat. Hist. Soc., Jan.* 13, 1872. *Cornell Era, Jan.* 19.

Your correspondent does not allow for the immense change that has been wrought in science within the last ten years, and forgets that while a young student may be well versed in the standard works of twenty years ago, in which many species rest upon less basis than "Bonasa Jobsii;" he would not, unless directed, be apt to see the recent periodical publications in which as yet appear the only evidences of the great and beneficial revolution from the "analytical" to the "synthetical" stage of science; and so the charge of "knowing nothing of ornithology" seems to us not only harsh but unwarranted. However, as Mr. Jaycox has so readily and cheerfully acknowledged his ornithological blunder, "Bonasa Jobsii" may be regarded as the name of an extinct species, and as laying no claim to synonymy with Bonasa umbellus, and we have only to comment upon some parts of the note which occasioned this communication.

The "Cornell Era" is *not* a "publication of an institution of learning" in any sense which entitles its contents to more consideration than other "newspaper science;" it is published under the sole direction of five students and it differs from other college periodicals mainly in its willingness to publish the proceedings of the various scientific societies. So neither the Era nor the University are in any way responsible for "Bonasa Jobsii" but the Natural History Society, from the proceedings of which the description was an extract, and by the President of which (and not by the President of the University as inferred by your correspondent) the specific name was suggested; and since some of your readers may know that the Professors of the University are honorary members of the Society, and often attend its meetings, it is but fair to them to state that none were present when "Bonasa Jobsii" was introduced; had they been, Mr. Jaycox would have been at once referred to the able papers of Mr. Allen (Bull. Mus. Comp. Zoöl. vol. i, No. 8, and vol. ii, No. 3) in which the whole subject of specific characters is discussed.

In conclusion I must allude to the contrast between the manner of your correspondent's criticism and those of Prof. Baird and Dr. Coues, who may fairly be regarded as exponents of the older and younger American ornithologists. Their notes are critical without being sarcastic; and they evince respect for the honest

though misdirected zeal of a young naturalist, instead of commiseration for an "ornithological blunder," and they include nothing that might not properly be said in the presence of the person criticised, and, now as "Bonasa Jobsii" is a thing of the past let us hope to hear no more of it, and that any reply to the foregoing will be confined to the question of scientific ethics and the limits of kindly criticism.—BURT S. WILDER, *Cornell University*.

ORNITHOLOGICAL BLUNDERS.—In the March number of the NATURALIST occur some remarks respecting "An Ornithological Blunder." Such a gross mistake as that made in the case of "*Bonasa Jobsii*" certainly demanded vigorous criticism; yet are there not palliating circumstances attending this "blunder" that render the language of your correspondent's critique unnecessarily harsh? To me it seems that there are. Unquestionably bad as was the work your correspondent was called to pass upon the indiscretion here alluded to was evidently encouraged, if not indeed actually induced, by equally unfortunate "blunders" previously made, not by mere tyros, but by recognized ornithological authorities. That this was the case seems evident from the comparisons and precedents cited in the remarks accompanying the description of *Bonasa Jobsii*. Is not, in fact, *Bonasa Jobsii* one of the legitimate fruits of the excessively analytic system followed in the only general works on North American ornithology accessible to students? The authors of these valuable works may have modified their opinions, and even their methods of working since the publication of those works, but as yet the general student has no means of knowing it. It seems to me that as long as species no more worthy of recognition than *Bonasa Jobsii* have the appearance of being currently accepted, because not yet publicly retracted, mistakes like that made by Mr. Jaycox need not be looked upon as wholly unpardonable. In fact if the author of *B. Jobsii* could have truthfully added, *Hab.* "Columbia River," or, "Hudson's Bay Territory," to his description, his pseudo-species might even now have been less summarily dealt with though none the less untenable. By these remarks, however, I do not by any means wish to encourage such kind of work, but merely desire to call attention to the fact that in Mr. Jaycox's case there are extenuating circumstances.—†††.

[We gladly make room for the above, from Prof. Wilder and

another esteemed contributor, with the remark that "our correspondent" who ranks with the best ornithologists of the day, performed his duty with the utmost good will towards the author of the new name, and was simply severe on the principle, and not on the author, as a warning to all young naturalists not to run headlong into print.—EDITORS.]

VIBRATIONS OF THE TAIL IN SNAKES.—Professor Shaler has a note on this subject in the Am. Naturalist, Jan. 1872, p. 35. In 1849 Professor S. F. Baird placed in my hands for translation, the invertebrate zoology of Heck's Iconographic Encyc., but finding it a poor compilation, I rewrote it, merely following the plates of the German edition. I incorporated various original observations of my own and the following passage occurs on p. 6-7 of *zoology*.

"Instinctive actions are not taught, although a permanent habit may become an instinct. The young duck swims at once, the young snapping turtle bites when taken from the egg, and a harmless serpent without fang or rattle will vibrate its tail like a rattlesnake producing a similar sound among dry leaves. The brain of the young is modelled upon that of the adult, and where the scale of ideas is limited, they must be as essentially hereditary as the external form. (In a note—These views are favorable to the doctrine of innate ideas, which is generally opposed by speculative reasoners.) The brain of the young is not necessarily that of the adult, but that of the adult at an earlier stage. So a quality or habit is not always transmissible from a parent to its immediate offspring, but it may appear in a more distant descendant, by a kind of alternation of generations."

Professor Cope (Proc. Am. Phil. Soc. July-Dec. 1871, p. 248,) mentions several poisonous and harmless snakes which vibrate the tail when excited—a phenomenon I observed in 1841.

A point in the extract affords an illustration of the ignorance of unscientific people, and their inability even to read scientific matter correctly. I had asserted that "the young snapping turtle bites when taken from the egg,"—I might have stated the fact a little stronger, for if touched, the unborn snapper turns its head and opens its mouth when the shell is broken sufficiently to expose the head. Seemingly on this statement, the "Atlantic Monthly" (May 1860, p. 516) asserts that—"Agassiz, who, knowing the savage snap of one of the full-grown *Testudinata*, is said to have asserted that, under the microscope [!] he has seen the juvenile turtle snapping precociously *in embryo*."—S. S. HALDEMAN, *Columbia, Pa.*

[Agassiz's original statement about the young turtle is in his Contr. Nat. Hist. U. S., i, p. 175 (1857) and is as follows:—In speaking of the "Succession of Characters" he says "The Snapping Turtle, for instance, exhibits its small crosslike sternum, its long tail, its ferocious habits, even before it leaves the egg, before it breathes through lungs, before its derm is ossified to form a bony shield, etc.; nay, it snaps with its gaping jaws at any thing brought near, though it be still surrounded by its amnios and allantois, and its yolk still exceeds in bulk its whole body." In a foot note he further adds, "Pr. M. v. New-Wied quotes as a remarkable fact, that the Chelonara serpentina bites as soon as it is hatched. I have seen it snapping in the same fierce manner as it does when full-grown, at a time it was still a pale, almost colorless embryo, wrapped up in its fœtal envelopes, with a yolk larger than itself hanging from its sternum, three months before hatching."—EDITORS.]

THE AFFINITIES OF CRINOIDS.—Metschnikoff, to whom we owe so many embryological investigations, has published preliminary notices* of the early stages of Comatula which are of the utmost importance, as they throw an entirely new light on the affinities of the Crinoids. Thoroughly familiar with the pluteus of Holothurians, Echini, Starfishes and Ophiurans, he commenced the investigations of their earlier stages with the determination of tracing the presence of the peculiar water system of the larvæ of the other orders of Echinoderms; what had been previously written by Busch, Allman and Thomson, on the early stages of Comatula, giving no date whatever bearing upon the subject.

To his surprise he found no such water system, nor could he trace anything in any way homologous to it; he also discovered that what constitutes the water-system of adult Crinoids, which has always been homologised with the water-system of other Echinoderms is developed in a totally different manner. In the free swimming Comatula larva the bag-like digestive sac is the only organ developed, it becomes the digestive cavity of the adult after the larva attaches itself to the ground. He noticed the tentacles as diverticula of the digestive sac in the interior of the larva; these subsequently force their way through to the exterior, at the time when the digestive bag has become further differentiated, and is provided with a mouth opening in the centre of the oval disk, and an anus opening not far from it on the side of the calyx. There

*Bulletin Acad. St. Petersburg, xv, p. 508, February, 1871.

is formed at this stage a large cavity which divides into two parts; the upper part, uniting the hollow tentacles at their base, forms the so-called circular canal, while below it, and connecting with it, we have a large cavity forming the perivisceral cavity, a mode of development of the circular ring and of the perivisceral cavity totally unlike that observed in Ophiurans, Starfishes, Echini and Holothurians.

Metschnikoff compares the mode of development of the upper and lower cavity to analogous processes in the embryonic growth of Alcyonella and other Bryozoa; he traces a striking similarity in the structure and position of the digestive organs and tentacles with similar organs of Bryozoa. However that may be, he has shown conclusively that the larva of Comatula has apparently nothing in common with other Echinoderm larvæ; but we must wait for his figures on this intricate subject before we can decide if the position he assigns to Crinoids is true to nature. — A. AGASSIZ, in *Amer. Jour. Sci.*

BIRDS NEW TO MASSACHUSETTS FAUNA.— I send you the following memoranda, of six species of birds, new to the fauna of this state taken within its limits by myself and friends, with the request that you will publish them in the NATURALIST :—

Hudsonian Titmouse (*Parus Hudsonicus*). On October 30th, 1870, I took an adult female at Concord, in company with a few Golden-crested Kinglets (*Regulus satrapa*).

European Ruff (*Philomachus pugnax*). Had a fine specimen sent me in the flesh from Newburyport marshes, May 20th, 1871. Upon dissection it proved a female, with the ovaries so much developed that I judged it would have laid within two or three weeks. This, Prof. Baird informs me, is the sixth that has been taken in America.

Baird's Sandpiper (*Actodromus Bairdii*). A specimen taken on Long Island in Boston harbor, Aug. 27th, 1870, by Mr. H. W. Henshaw of Grantville, Massachusetts. This is I believe the first note of the occurrence of this bird on the Atlantic coast.

Havel's Tern (*Thallaseus Havelli*). A single specimen taken on Ipswich beach by Mr. C. J. Maynard, September 1870.

Marsh Tern (*Geochelidon Anglica*). One taken on Ipswich beach, September, 1871, by Mr. C. J. Maynard.

Barrow's Goldeneye (*Bucephala Islandica*). I obtained an adult

female in the flesh from Cape Cod, December 7th, 1871, which was pronounced by Prof. Baird unquestionably *B. Islandica.* Since then I have seen numbers of females and two fine adult males in the Boston markets, most of them shot within state limits.

Mr. Maynard also informs me that he took two more specimens of Baird's Sparrow (*Centronyx Bairdii*), October 14th and 15th, on the Ipswich sandhills, thereby confirming the hypothesis advanced by him in the "Naturalist's Guide," namely, that they are regular winter visitants from the North.

The Stilt Sandpiper (*Micropalma himantopus*) which I see was recorded in a recent number of the NATURALIST as new to our fauna, I consider by no means rare in its migrations. Indeed, I have seen as many as six or seven sent into Boston market at one time, from Cape Cod, and in the course of a few weeks' shooting in August, at Rye Beach, N. H. (just north of our state limits), secured no less than ten specimens.—WILLIAM BREWSTER, *Cambridge, Mass.*

ERROR IN DARWIN'S ORIGIN OF SPECIES. In the last edition of the above work, p. 149, Mr. Darwin misstates Hyatt and Cope's law of Acceleration and Retardation in the following language:

> "There is another possible mode of transition, namely, through the acceleration and retardation of the period of reproduction. This view has lately been insisted on by Prof. Cope and others in the United States. It is now known that some animals are capable of reproduction at a very early age, before they have acquired their perfect characters," etc.

Prof. Cope and others have not insisted on the above proposition, which we imagine to be supported by very few facts. Their theory of acceleration and retardation states; that, while the period of reproductive maturity arrives at nearly the same age or period of the year in most individuals of a single sex and species, the portion of the developmental scale which they traverse in that time, may vary much. That an addition to the series of changes traversed by the parent, would require in another generation, a more rapid growth in respect to the series in question, which is *acceleration.* A falling short of accomplishing that completeness, would result from a slower growth, hence the *process* is termed retardation. Vast numbers of observed facts prove that this is the great *law of variation* towards which little progress has yet been made

by students who are yet chiefly occupied with the coöperative law of natural selection.

Acceleration and retardation of the period of reproduction may possibly have occurred; but the only case in which it has been recognized in connection with the above law, has been in regard to sex. In the human species at least, differences in several characters, mostly metaphysical, seen in the sexes and in certain races, may be consequences of the earlier or later appearance of maturity in this point. — Z.

PARTHENOGENESIS AMONG LEPIDOPTERA.—The Dutch naturalist M. H. Weizenbergh jr. has performed a series of experiments on this interesting subject, the insect placed under observation being *Liparis dispar*, and concludes that it is possible for at least three successive generations to be produced without access of the male to the female. The following are the results of his very careful experiments: — (1) August, 1866, eggs laid by impregnated females; April, 1867, caterpillars appear, and in July perfect butterflies. (2) August, 1867, eggs laid by females of this year are without impregnation; April, 1868, caterpillars appear, and in July perfect butterflies. (3) August, 1868, eggs laid by females of this year without impregnation; April, 1869 caterpillars appear, and in July perfect butterflies. (4) August, 1869, eggs laid by the females of this year without impregnation; April, 1870, no results, the eggs all dried up. The power of reproduction appeared to decrease year by year when impregnation was prevented. Similar results have been noticed in other butterflies, in bees, and notably in aphides.—A. W. B.

NATURALIZATION OF SALMONIDÆ. — The American brook trout, *Salmo fontinalis*, is now thoroughly established in England, where it is the admiration of pisciculturists.

There seems to be no question about the success of the attempt to introduce the European trout, *S. fario*, into the rivers Derwent and Plenty in Tasmania, good-sized fish of that species being occasionally caught there. As to salmon (*S. salar*) and salmon trout (*S. trutta*), the evidence of success is not so conclusive. A letter from Tasmania, dated Dec. 30, 1871, and published in "Land and Water," asserts that there is no doubt that the Derwent is becoming yearly, more and more fully stocked with them, yet admits that no adult salmon have been caught. James A. Youl says that

the salmon and salmon trout have bred in the Plenty ponds, in fresh water, without ever having a chance of emigrating to the sea. Frank Buckland proposes to send out a net, wherewith to test the presence of salmon, from which we may infer that such an obvious means of ascertaining the facts has not yet been tried, although there was ocular proof of the presence of great numbers of fish supposed to belong to the two species in question. The eggs from which the Salmonidæ now in Tasmania, are descended, were sent out packed in ice. A large case of salmoneggs was shipped for New Zealand, last November, packed without ice, in glass jars with damp moss. — C. G. A.

Curious Habits of a Snake. I had for some time living in a Wardian case, a specimen of *Cyclophis æstivus*, received from Ft. Macon, N. C., through the kindness of Dr. Yarrow. The slender form of this snake, and its beautiful green and yellow co'ors have led to the opinion that it is of arboreal or bush-loving habits. It never exhibited such in confinement, however, and instead of climbing over the ferns, etc., lived mostly underground. It had an envious habit of projecting its head and two or three inches of its body above the ground, and holding itself for hours rigidly in a single attitude. In this position it resembled very closely a sprout or shoot of some green succulent plant, and might readily be mistaken for such by small animals. — Edw. D. Cope.

More about Singing Mice. — A correspondent whose name is withheld sends me something that may interest your readers:

Dear Doctor. — You are quite correct, I think, when you say, as reported in the "Sun" of this morning, that the peculiarity of singing mice is not due to a diseased condition. After breeding nearly three hundred white mice with the hope of meeting one of these vocalists I at last succeeded in getting *one* and no more, yet, strange to say, he has never displayed his accomplishment more than three or four times, and he is seven or eight months old. The means I have found to induce him to sing are to keep him in a case deprived of all society and without exercise for several weeks. Upon being placed in a little tin cottage to which is attached a cylinder, he becomes very excited and joyous, and turns round and round twittering his curious note and testifying his pleasure in every possible manner. He is always in perfect health, and the young bred from him are the strongest and largest I have ever produced. He is also tame, very knowing, very pretty, and about as agreeable a companion as a solitary person could desire. I

infer that your mouse is of the ordinary color. I may mention, at the risk of telling you something you know already, that there is a kind of hiccoughing mouse; I also had one of these, but going one day on an exploring expedition in the wilds of a deserted rubbish room, he was lost, night overtook him and he froze to death.

This letter was occasioned by some general remarks made before the Maryland Academy of Science, *à propos* of Dr. Lockwood's recent article, which, like everything else he writes for the NATURALIST, is simply delightful. The whole subject is interesting. Who knows that mice have not *normally* the ability of so modulating the voice as to produce musical notes, though the faculty may be only occasionally exercised? Birds themselves, as a rule, sing chiefly under the special stimulus of the breeding season. True vocal music having been generally, but perhaps too hastily, supposed to be confined to birds more information is desirable. Who can contribute something? — ELLIOTT COUES.

THE MUSIC OF THE RATTLESNAKE. — I have nothing to say in reference to Prof. Shaler's theory of the use of rattles to the snake, but while botanizing over the marshes of Michigan during the past few years, I have had a chance to become familiar with the sound of the rattles of the Massasauga. It is so much like the singing of some grasshoppers that I have often mistaken the sound of the insect for that of the serpent. — W. J. BEAL, *Mich. Agr. College.*

MELANISM. — Noticing what Dr. Wood says, in the last number of the NATURALIST, about "melanism," it occurs to me to say that black woodchucks are found in this region and in Washington, N. H.; and I have had a perfectly black chipmunk from Milford. — SANBORN TENNEY, *Williamstown, Mass.*

GEOLOGY.

GLACIERS IN THE ROCKY MOUNTAINS.— In the NATURALIST for February, in an article on "The Mountains of Colorado, Dr. J. W. Foster denies the existence of any evidence indicating the former presence of glaciers in the Rocky Mountains. He says that so far as he observed none of the rock surfaces are polished and striated, and that those accumulations of sand and gravel in the nature of terminal moraines are entirely wanting.

With regard to the existence of terminal moraines I am con-

vinced that Dr. Foster is in error. Mr. Henry Gannett, who spent the summer of 1869 in South Park, and the region about Gray's Peak, informs me that a number of well defined terminal moraines may be seen west of Gray's Peak on the trail leading from Montezuma up the peak, and that on Clear Creek, which Dr. Foster says he took as his line of observation, near Fall River may be seen another terminal moraine. Mr. Gannett's testimony is confirmed by several other members of the party he accompanied.

Dr. Foster is undoubtedly right in saying that in the region he visited the rocks exhibit no traces of glacial markings. The granites and syenites that are first met with on entering the Rocky Mountains from the east are exceedingly friable and decompose with the greatest rapidity on exposure to the atmosphere, so that under these circumstances the planed and striated rock surfaces would long since have disappeared. It is only when passing westward, we approach the outlying spurs of the Snowy Range that the granites begin to be hard enough to retain any traces of glacial action.

Last summer in the collecting expedition to the Rocky Mountains sent out by the Museum of Comparative Zoölogy, Mr. Allen and myself had on one occasion opportunity of observing such traces of ice action as to leave in our minds no doubt of the former existence of glaciers in those mountains. These evidences of glaciation we saw near Montgomery, a mining town on the head waters of the South Platte in the northwestern part of Park county. The South Platte rises in the spur of mountains running west from Mt. Lincoln and flows eastward for about five miles through a broad gulch, the walls of which range in height from eight hundred to fifteen hundred feet. From an examination of the exposed surfaces of the rocks forming the sides and floor of the gulch, made by Mr. Allen and myself, I am convinced that at some former time the whole valley must have been filled with ice moving downward toward South Park. Wherever the rocks had not been disturbed by mining operations they were worn perfectly smooth and deeply furrowed with glacial striæ. I noticed several places where projecting rocks were polished and furrowed on the side facing up the gulch; and left untouched on the opposite side, showing that the ice field had moved down the gulch toward the Park. Near the lower end of the gulch I traced the glaciation to a height of eight hundred and more feet, or to the point where the

exposed rocks were covered with detritus resulting from a disintegration of the higher peaks by atmospheric agencies.— RICHARD BLISS, JR., *Cambridge*.

DISCOVERY OF AN EXTINCT GIGANTIC BIRD OF PREY IN NEW ZEALAND. — Mr. F. Fuller, while directing some excavations in a marsh on the Glenmark estate, province of Canterbury, South Island, New Zealand, by permission of G. H. Moore, Esq. (whose researches have added so greatly to the evidences of the extinct birds of New Zealand), found, among remains of *Dinornis* exhumed at a depth of five or six feet from the surface, a few smaller bones, including claw-phalanges, which Mr. Fuller recognized as belonging to a large bird of prey. With two claw-phalanges were found a left femur, a vertebral rib with its anchylosed "epipleural appendage;" and, in a watercourse about two miles from Glenmark, a mutilated right humerus was subsequently discovered, and pronounced by Dr. Haast to be raptorial, and, as well as other and better preserved bones, most nearly resembling the corresponding bones of the New Zealand harrier (*Circus assimilis* Jardine). Dr. Haast, F.R.S., the accomplished state geologist of the province of Canterbury, has communicated an instructive and interesting memoir on these remains to the *Transactions of the Philosophical Institute of Canterbury*. He refers the gigantic raptorial bird of New Zealand, which was twice the size or bulk of the great wedge-tailed eagle of Australia (*Aquila audax* Gould), to the genus *Harpagornis*, Haast, giving it the specific name *Moorei*, after the liberal partner of Kermode and Co., owners of the Glenmark property. He conjectures, on good grounds, that this huge raptorial bird preyed upon the young or feeble individuals of the genus *Dinornis*, and, with them, became extinct. Dr. Haast deduces from this discovery an additional confirmation of his belief that the present aboriginals of New Zealand do not possess any traditions about the gigantic Moas, and writes, "that, if trustworthy traditions about the *Dinornis* had been handed down to us, the still more alarming existence of this gigantic bird of prey contemporaneous with the former would most certainly have also been recorded." I may remark that the individual who, in 1839, submitted to me, with other New Zealand rarities, the fragment of bone which gave the first evidence of great wingless birds in that island, stated that the natives from whom he obtained it had "a

tradition that it belonged to a bird of the eagle kind which had become extinct, and to which they gave the name of 'Movie.'" (*Proceedings of the Zoological Society of London*, Nov. 12, 1839, p. 169.) I am now, of course, disposed to attach more weight to this tradition than when it rested on a fossil proved to belong to a bird which could not fly, and which was at least as large as an ostrich. We may suppose the great raptorial species which we now know to have co-existed with the *Dinornithes* to have survived, by reason of its greater powers of escape, some time after the extinction of its principal prey; and the tradition of the great bird "of the eagle kind" may be a consequence of the knowledge of the *Harpagornis* continuing down to later generations of Maories than those who hunted down the huge herbivorous flightless birds.— RICHARD OWEN, *in the Academy*.

ANTHROPOLOGY.

ANOTHER LAKE VILLAGE. — "An interesting archæological discovery has recently been made on the shores of the Lake of Bienne. The Swiss Government has been for a long time endeavoring to drain a considerable tract of land between the two lakes of Morat and Bienne, but in order to do this effectually it has been found necessary to lower the level of the latter by cutting a canal from it to the lake of Neuchatel. At the beginning of the present year the sluices were opened, and the waters of the Lake of Bienne allowed to flow into that of Neuchatel. Up to the present time the level of the Bieler See has fallen upwards of three feet, and this fall has brought to light a number of stakes driven firmly into the bed of the lake. This fact becoming known, a number of Swiss archæologists visited the spot, and it was decided to remove the soil round these stakes to see whether any remains of a Lacustrine village, which they suspected had been raised upon them, could be traced. At a distance of between five and six feet from the present bed of the lake the workmen came upon a large number of objects of various kinds, which have been collected and are at present under the custody of Dr. Gross of Locrass. Among them are pieces of cord made from hemp, vases, stags' horns, stone hatchets, and utensils used apparently for cooking. The most precious specimen is, however, a hatchet made of néphrite (the name given to a peculiarly hard kind of stone from which the La-

custrines formed their cutting instruments). This hatchet is sixteen centimetres long by seven broad, and is by far the largest yet discovered in any part of Switzerland, no other collection having any measuring more than eight centimetres in length. A quantity of the bones found at the same time have been sent to Dr. Uhlmann, of Münchenbuchsee, for examination by him, and he finds that they belong to the following animals, viz:— stag, horse, ox, wild boar, pig, goat, beaver, dog, mouse, etc., together with a number of human bones. If the level of the lake continues to sink, it is hoped that further discoveries will be made, and the scientific world here is waiting the result of the engineering operations with keen interest." — *The Standard.* — *Nature.*

MICROSCOPY.

THE MICROSCOPE IN THE LECTURE ROOM.—Dr. N. J. C. Müller of Heidelberg sends a notice to the "Botanische Zeitung" of his experience in the use of the microscope in his botanical lectures, that deserves the attention of those who desire the help of the microscope in illustrating scientific lectures. The objections to the plan of bringing in a number of instruments under each of which a preparation has been placed, are many and serious. The most important is perhaps the difficulty which one unaccustomed to the use of the microscope has in understanding the new and strange appearances presented, and that while looking at the prominent objects in sight, such as air bubbles and foreign bodies of marked and strong outline, he misses altogether the real object which ought to have been seen. The experiment of using the ordinary microscope as a solar microscope and presenting the image of the object on a screen where it could be seen by the whole class at once, and their attention directed to the important points, was tried last summer, and with the most marked success. He used one of Hartnack's first class instruments clamped in a horizontal position and received the image on a screen distant from five to eight metres making an image of two to three metres in diameter. An heliostat and one or two condensing lenses directed the light on the object. The microscope was so placed that the stage was somewhat this side of the focus of the collecting lens. When images were desired as free as possible from spherical aberration the ocular was removed and the image taken directly

from the objective; when on the other hand the greatest possible amplification was desired, then both objective and ocular were used. In this way by the use of Hartnack's immersion lenses the finest test objects were exhibited, and the six sided spaces of the Pleurosigma shown as four to five millimetres in diameter. For such times as sunlight is not available he recommends the Drummond light, and promises to give the results of his experience in its use.

In place of the expensive heliostat, no doubt the simple arrangement often used by lecturers on Natural Philosophy might be adopted. It consists of a mirror outside the window movable in two directions by means of screws whose heads come within the room.— T. D. B.

Angular Aperture.— Dr. Pigott revives the subject of diaphragms behind the objective, and reports some very remarkable results somewhat similar, of course, to those resulting from the use of an achromatic condenser of very small angular aperture. He does not demonstrate the advantages of using a diaphragm over the objective as compared with the other and more usual method.

Preparation and Preservation of Tissues.— Dr. J. J. Woodward commences, in "The Lens," a summary of the various methods employed for this purpose. He prefers to harden the tissue by gradual dehydration by means of alcohol, and to cut it (imbedded if small, in paraffine) either off-hand or in a common section machine. By the latter means sections less than one-two-hundredth of an inch thick are easily obtained. He covers the top of the section machine with a glass plate suitably perforated and cemented fast by means of marine glue; and advises that the alcohol used to dehydrate the specimens be saved and filtered for the preservation of large anatomical specimens.

Dr. I. N. Danforth gives, in the same Journal, his methods of preparation, the main object of which is simplification of the usual procedures. He makes the pithy assertion that success depends more upon tact than upon tools. He cuts the sections from perfectly fresh tissues, by means of a thin, single-bladed knife; invariably stains them, preferring for this purpose Beale's carmine solution; washes them in diluted and acidulated glycerine; and preserves them in slightly acidulated glycerine. He very

properly denounces the slovenly custom of carrying home fresh specimens of tissues, etc., wrapped in a rag or newspaper. The policy of cutting fresh tissues frozen, which is coming into use here and abroad, seems to have escaped his notice, as it is neither adopted nor condemned and is too important an innovation to be ignored.

Absorption of Solid Particles.—"The Lancet" reviews this interesting and timely subject. Oesterlen, nearly thirty years ago, found molecules of mercury in the blood of cats, absorbed from the stomach; and he, Eberhard, Landerer, and especially Voit, rubbed the same material into the skin of cats and dogs and found it in the liver, spleen, and other internal organs. The experiments of Herbst and Bruch seemed to demonstrate the absorption into the bloodvessels of milk-globules and starch-granules; Marfels and Moleschott fed frogs on blood-corpuscles and pigment-corpuscles of sheep, and saw these corpuscles circulating in the web of the frog's foot; while Donders and Mensonides found charcoal in the blood of rabbits with whose food it had been mixed. Thus the absorption of solid particles through uninjured membranes has become nearly certain notwithstanding the negative results obtained by Bärensprung, Recklinghausen, and a few other experimenters. M. Heinrich Auspitz has recently continued these researches by means of rice-starch the granules of which, easily used on account of their small specific weight, and easily recognized by their form and by the iodine color-test, vary from about the size of the red corpuscles of the animal used (the rabbit) to about twenty times as large. Starch injected into the veins, he detected in all the organs of the body; and starch suspended in water or still better in oil, was injected into the serous cavities and into the subcutaneous cellular tissue, and subsequently recognized in the circulation.

Multiplying Species.—In describing a new variety of Lepidodendron stem, before the Royal Microscopical Society, Mr. W. Carruthers, F.R.S., states that it would be in accordance with usage to give a specific name to the new fragment. He refrains, however, for want of sufficient data, and gives the following racy illustration of the method of those investigators who set aside the work of previous workers and recklessly give new names to fragmentary specimens. "Suppose, for instance, it were discovered that we had in this country another *Papilio* beside the Swallow-tail, and

that one entomologist got hold of a hind wing and found that it had two tails, and so full of his important discovery he figures and describes his fragment as *P. bicaudatus* Mihi; another finds a head with the antennæ attached, and these are obviously more club-shaped than the known species, and of course it is *P. clavatus* Mihi; the body falls into the hands of a third, and it is thick and short and blunt, and easily distinguished from *Machaon*, so it becomes *P. truncatus* Mihi; the fore wing turns up, and it has got blue lines and spots and it would be absurd not to give this new species a name, and it is *P. cæruleus* Mihi; but the body is investigated by an entomologist with an anatomical bias, and he makes some important observations deserving to be published; and the subject must have a name, so it becomes *P. intestinalis* Mihi; and to terminate an illustration which might be carried to any extent, the caterpillar is found in a field of carrots; a discovery so important must be published at once, and it is *P. carrotæ* Mihi. The absurdity of such proceedings is apparent from such an illustration as this, but in fossil botany the terrible reality has to be encountered, and not only roots, stems, branches, leaves and fruit get different names, but different states of the same stem receive different generic and specific names."

Development of Vegetable and Animal Life.—Dr. T. C. Hilgard sums up his peculiar views on this subject in a recent lecture before the New Orleans Academy of Sciences. He recognizes no such classes as Protophyta and Protozoa; but states that "all the so-called infusoria, all the *protozoa*, *protophyta* and fresh water algæ, so called, are severally and collectively in all known cases, the immature but even thus self multiplying germs of higher (or adult) forms of plants and animals, otherwise well known for themselves." Some of the observations leading to these conclusions have been already published, and others are promised in the Proc. A. A. A. S. for 1871. Somewhat similar views were published by Metcalf Johnson, in the Monthly Microscopical Journal. Though not at present received by scientific men, to any extent, these theories must be admitted to be not only ingenious, but suggestive of further investigation.

The Leucocytes.—Prof. Hoppe-Seyler's recent investigations of the white corpuscles of blood, lymph and pus, give somewhat novel and very interesting results. Their original identity is admitted,

but a manifest and permanent differentiation is claimed to occur. By an ingenious experiment, glycogen was detected in lymph-cells. Their glycogenic properties are lost when lymph or white blood-corpuscles become transformed into non-contractile pus-corpuscles, which latter, by excess of oxygen, may undergo fatty degeneration, or, by long immersion in water, other changes due to the presence of oxygen. There also seems to be a close chemical relationship between pus-corpuscles and yeast-cells.

Exogens and Endogens.—At a recent meeting of the Royal Microscopical Society, Prof. T. Dyer expressed himself satisfied of an exogenous growth in *Lepidodendron*, notwithstanding its evidently cryptogamic character. He considered De Candolle's terms exogens and endogens to be already generally abandoned in favor of John Ray's previous names Dicotyledons and Monocotyledons. Recent researches, especially those of Mohl, had proved that Monocotyledons were really not endogenous, but acrogenous; and some cryptogams, as lichens and algæ, as well as Monocotyledons, are regularly exogenous. The speaker regretted that the study of palæontology was so much separated from that of recent organisms. He would like to see fossil and recent specimens not only studied by the same systematists, but arranged side by side in the museums.

A Conspectus of the Diatomaceæ.—This mature and very valuable work by Prof. H. L. Smith, has begun to appear in "The Lens." Diatomists will look with interest for the succeeding numbers.

Photo-micrographs Popularized.—It is to be hoped that microscopists, and others interested in scientific progress, will notice and appreciate the effort now being made, by Mr. C. Meinerth of Newburyport, Mass., to supply "in a cheap and convenient form" really good photographic representations of microscopic objects. Judging from the work already done, Mr. Meinerth's enterprise will prove both entertaining and instructive to the cultivated public.

NOTES.

San Francisco Meeting of the American Association for the Advancement of Science. In our last number we announced that the committee having the matter in charge had decided that the

next meeting of the Association would be held in San Francisco. The only additional information we have received, up to the time of going to press, is in relation to the price of tickets from Omaha, as follows; MEMBERS of the Association will be furnished with a ticket from Omaha to San Francisco and return to Omaha for $63.50 for the round trip, and there is every probability that arrangements will be perfected by which members will be passed at half fare from various points East to Omaha. The committee will undoubtedly issue their circular to members very soon, and we trust that there will be a large attendance, as the meeting will be a most important one in many ways, while the great concessions on the part of the Railroads should induce eastern members to take advantage of the opportunity to visit the, in many points, most interesting state in our country.

THE latest news we have of the Hasler and her corps of scientists, is from Montevideo, Feb. 24th, at which date, Mr. J. H. Blake wrote to us, giving a general account of the expedition to that time, but as his remarks are about the same as those already published in the newspapers we omit the details. Quite extensive collections have been made and several lots already forwarded to Cambridge from the various stopping places which, up to date of the letter, were St. Thomas (Jan. 15), Santa Cruz, Barbadoes, Pernambuco, Rio de Janeiro, and Montevideo (Feb. 24). The most successful dredgings were made off the western side of Barbadoes, in ninety fathoms.

OBITUARY. PROF. THOS. RUSSELL CROSBY, M. D. *Extract from the Minutes of the Dartmouth Scientific Association.*

Whereas, it has pleased our Heavenly Father, in his wise Providence, to remove unexpectedly from among us, by the hand of death, the first President of this organization, our beloved associate, Prof. Thos. Russell Crosby, M. D.

Resolved, that in the death of Prof. Crosby, this Association has lost one who, by the extent of his learning and the excellence of his character, has been a most valuable and highly esteemed member; that to the Association as a body, and to the individuals as members, the loss is that of a friend and brother, and is most deeply felt; and that we tender the family and friends of the deceased our most heartfelt sympathy in their affliction.

Resolved, that a copy of these resolutions be furnished the family and friends, and, moreover, be sent for publication to the NATURALIST, and several other journals.

ANSWERS TO CORRESPONDENTS.

P. L., Boston, Mass.—It is not uncommon for the Muskrat to travel some distance from the water, and even to enter sheds and outbuildings in search of food, especially during mild weather in winter.—J. A. A.

J. O., Poughkeepsie.—The dried puparium you send from Ft. Gibson, is very much like that of *Merodon bardus* Say, figured in "Packard's Guide to Study of Insects," p. 899, fig. 319, *a*.—F. W. P.

A number of letters and notes relating to Entomological matters will have to remain unanswered until Dr. Packard's return from Europe in July.—F. W. P.

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Orages en Belgique en 1870 et Aurore Boreale des 24 et 25 Octobre 1870. By M. Ad. Quetelet. 8vo. Pamph.

Memorial Notice of Sir John F. W. Herschel. 8vo. Pamph. By M. Ad. Quetelet.

Observations des Phenomenes Periodiques pendant les annees 1867, 1868 et 1869. (*Extrait des tomes* xxxviii et xxxix *des Memoires, Academie Royale de Belgique*). 4to. 2 Pamph.

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STUDENTS' MICROSCOPES.*

BY R. H. WARD, M. D.

THOSE who use the microscope as an elegant and costly luxury will, of course, be guided in so doing by their general ideas of taste, economy, etc.; the few who use the instrument as medical experts, or original investigators in science, will, at the same time, by years of practice, grow into the use and the possession of an instrument suited to their wants; but a larger class are those who use the instrument as an incidental though frequent aid in their daily work in various sciences or professions, who reasonably desire the simplest instruments consistent with real usefulness, and who, however eminent in other specialties, are often unfamiliar with the styles and prices of the various makers, and at a loss to know what available resources would best supply their wants. The following tables are designed to be of use to buyers of microscopes, of the latter class, and to persons who desire information in a concise and convenient form, in regard to the progress thus far made in this department of microscopy. While the styles and prices will be subject to endless variation, the statements made will be sufficiently accurate to form a basis for selection and correspondence for a considerable time.

For the convenience of persons who desire to compare our styles with those of European makers, the table of American Students' Microscopes has been rearranged so as to correspond in form with Dr. J. F. Payne's recently published table of European instru-

*From a paper on Medical Microscopes, read at the Medical Society of the State of New York, Feb. 7, 1872.

ments.* Only standard and available styles are given, by reliable American makers, and no such makers have been intentionally omitted. The selection of instruments and apparatus of the different makers is entirely the responsibility of the writer, and not of the makers. He has selected such sets, at the makers' prices, as he has been accustomed to recommend to students and others for the general purposes of students' microscopes.

The table of Objectives is designed to be complete in regard to American lenses, and to present for comparison, and for the convenience of those who desire a variety of lenses by different makers, such European items as could be obtained at the time of writing. It is believed that the table will be interesting to others than buyers, as showing the prevailing powers, prices, angular apertures etc., in different parts of the world. Notwithstanding the general impression that the prices of American objectives are unreasonably high, it will be seen that they compare favorably with those of the most celebrated English makers. Most opticians prepare very cheaply mounted objectives of small angle, and usually second quality, which answer a good purpose where economy is imperative and difficult work is not required. Such lenses are not usually priced and sold separately by the American makers, and are therefore not included in their columns in the table of objectives.† They can be obtained, however, at prices proportioned to their angles and quality. The prices and angular apertures given in the table are generally, though not in every case, official and up to date; but a reasonable allowance must be made for practical variation from the standard angles and powers. There is understood to be a screw-collar adjustment for all objectives of over 50° angular aperture, unless otherwise stated, though, from want of sufficiently distinct description by their makers, this rule cannot be applied to some of the English lenses of medium power and small angle. To persons without great experience in microscopy, the best "test" of an objective is the respectability of its maker.

The Binocular Microscope, though not especially applicable to medical microscopy, is of such general usefulness that it should be preferred in all cases where its price is not a positive objection. Binoculars are furnished, when ordered, even by those makers who do not manufacture them.

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*Quart. Jour. Mic. Sci., Jan. 1872.

†This remark would also apply to a few of the English opticians.

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a. See Table of Students' Microscopes.
b. C. Baker, 243 and 244 High Holborn, London, England.
c. R. & J. Beck, 31 Cornhill, E C., " "
d. Jno. Browning, 63 Strand, W. C., " "
e. Chas. Collins, 157c, Great Portland street, Portland Place, W., London, Eng.

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a. Mounts, to special order, objectives as high as 1-10 inch, to work well on any binocular stand.

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. extra.
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nmersion and adjustable.
xtra.
10s. extra.

SYNOPSIS OF STUDENTS' MICROSCOPES.

MODEL.

Must have joint to incline at various angles from horizontal to perpendicular.

Curved Bar. — "Jackson" (but not prolonged beneath stage); steadiest form for equal weights.

Transverse Bar. — Most convenient in some respects.

WEIGHT.

Four to ten pounds. — A question of convenience *vs* firmness.

HEIGHT. (12 to 16 inches.)

Tall. — Much room below stage. Standard length of tube gives usual powers. Looks well, and is most convenient when inclined.

Short. — Easiest for vertical use. Short tube works lenses at too low power. Should be lengthened by draw-tube when inclined.

DIAMETER OF TUBE. (1 to 1 3-8 in.)

Small. — Looks best and is steadiest on small instruments.

Large. — Gives wider field with low power oculars.

MATERIAL.

All Brass. — Looks best.

Iron Base. — Saves expense. Wears well unless broken by falling.

COARSE ADJUSTMENT.

Rack and Pinion. — Easiest; preferable but costly.

Friction Pinion. — Said to be very delicate.

Chain Movement. — Fine motion. Easily repaired if necessary.

Sliding Tube, by hand. — Saves expense. Most delicate, but awkward. Wants expert hands, and often two of them.

FINE ADJUSTMENT. Essential.

Screw and lever moving nose-piece. —Best. Costly.

Screw and lever moving compound body. — Good for moderate powers.

Screw moving compound body. — Less delicate.

Screw against shoulder, moving nose-piece. — Less delicate.

Screw on nose-piece. — Little used.

Screw moving stage. — Cheapest in use in this country. Bad in theory and history; but quite satisfactory in use, as made at present.

Bar moving pinion of rack. — Not in this country. Good for low powers. May be added to instruments having no other fine adjustment.

STAGE.

Mechanical. — Not required.

Lever. — Plausible, but not successful.

Magnetic. — Plausible, but not successful. (Insecure.)

Hand movement. (In two rectangular directions.) — Best substitute for mechanical, for high powers, and with Maltwood Finder.

Glass, concentric. — Best for Binocular.

Glass, sliding by hand. — Cannot be too highly commended for ordinary medical use.

Brass.—Sliding by hand (cloth-lined, or otherwise). A good and cheap substitute.

Plain. — Saves expense. Should have removable spring clips. Could have glass or brass sliding-stage added.

MIRROR.

Must have lateral, vertical and two rotary movements.

Lateral movement by cranked arm: not common in students' microscopes. Lateral movement by mirror swinging partly around the bar which carries it. Lateral movement by hinge joint at top of bar which carries mirror: obliquity entirely independent of distance of mirror from object.

Concave. — Indispensable. Should be nearly two inches wide.

Plane. — Very desirable and costs little. May be smaller.

DIAPHRAGM.

Fitting should be removable, for oblique light.

Disc with apertures.— Essential. Should be closed between diaphragm and stage to prevent accidental oblique light.

"*Graduating*" or "*Iris.*"—Incomparably best, but unnecessarily expensive.

OCULARS (eye-pieces).

Negative (Huyghens') always meant, unless otherwise stated. Quality (and performance) varies greatly, though seldom suspected.

Two-inch. — (The A or No. 1 of most makers.) X* 5. Best for general use. Should always be negative.

One-inch. — (Often named B or C, or No. 2 or 3.) X 10. Use for Micrometry, occasionally for observations, and generally as achromatic condenser. If willing to add $5.00 or $10.00, substitute Kellner's orthoscopic, by European or American makers (superb field), or Tolles' orthoscopic, by Boston Optical Works (field narrower, but peculiarly clear).

OBJECTIVES. (If extravagant anywhere, put it here.)

All above 50° angular aperture, should have adjustment for cover glass.

All above about 75° must have the same.

Screw collar. — Best.

Screw movement of outer tube.—Good for cheap lenses of small angles.

Sliding movement of outer tube, with oblique slot.—Good for cheap lenses of small angles.

One-inch. — X 10 (with lowest ocular, X about 50). Should be about 25° angular aperture.

One-fourth or one-fifth inch. —X 40 or 50 (with low ocular, X about 200 or 250). May be 75° to 85°.

One-sixth to one-eighth inch. — X 60 to 80. (With low ocular, X about 300 to 400.) Should be 120° to 140°. Best added after a few years' experience with the others.

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* Magnifies, diameters.

MAGNIFYING POWERS.

Quality more than quantity.

Theoretical. — One inch X 10. Oculars and objectives as above, X 50, 100, 200, 400, 800.

Practical. — Should approximate to this.

ACCESSORIES.

Essential, and should be furnished free.

A few glass slides and covers; stage-plates with ledge; pipettes; pliers; and needles mounted in handles.

Desirable, for medical and general use.

Compressorium, or *animalcule cage.*

Curved scissors (sideways).

Camera lucida, for drawing and micrometry.*

Stage micrometer.

Graduated Draw-tube.

Cylindrical fitting, below stage, to use ocular for achromatic condenser.

Reagents. (In twelve one or two ounce vials.)

Turn table, and mounting materials.

Desirable, more for general than medical use.

Condensing lens, on separate stand, for opaque objects, and for parallel light, etc.; or *condensing lens* to limb or stage of instrument, for opaque objects; or *mirror on curved arm*, to swing above stage, for opaque objects; or *mirror removable* to stage or separate stand for opaque objects.

Spotted lens, or glass paraboloid, for translucent objects.

Stage forceps.

Maltwood finder.

PRICE.

Including walnut or mahogany case, $50 to $100. Varies with quantity and quality of work and reputation of maker.

Less, at present, unsatisfactory.

More, unnecessary.

About double, by substituting binocular stand.

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* For occasional measurements the camera is entirely satisfactory. Where large numbers of measurements are to be made, this method is not sufficiently rapid and convenient. Dr. White's micrometer, a semicircle of thin glass, graduated at the straight edge, and lying upon the diaphragm in focus of the eye lens, is most used by the writer for this purpose. With low powers the object is easily brought up obliquely to the required position; for high powers the Jackson adjusting screw must be used, unless the stand have a mechanical stage. The simplest ocular micrometer, and best for general students' use, is a circular disc cut, to fit, from the centre of a rather thin stage-micrometer graduated to hundredths or to two-hundredths of an inch, and lying, only when used, upon the diaphragm in the ocular like Dr. White's form. This rather thick circle is more durable, more easily obtained and handled, and capable of giving unexpectedly good results. It should cost $2 or $3.

Name and address of maker.	Name of instrument.	Model.	Height (in inches) with high powers.	Weight (in lbs.)	Inside diameter of tube (in inches).	Material (brass except as stated).	Coarse a[d]justmen[t]
Boston Optical Works.* Chas. Stodder, Agent, 66 Milk St., Boston.	Tolles' Students' Microscope.	Jackson.†	$15\frac{1}{2}$	6	.96	Iron base and arm.	Sliding tu[be] with s[teel] spring.
Boston Optical Works.* Chas. Stodder, Agent, 66 Milk St., Boston.	Tolles' Students' Microscope.	Jackson.†	$15\frac{1}{2}$	6	.96	Iron base and arm. $10.00 extra for all brass.	Rack a[nd] pinion.
J. Grunow, 410 Fourth Av., N. Y.	Students' Microscope (horse-shoe base).	Transverse bar.	12	5	$\frac{31}{32}$	Brass.	Sliding tub[e]
J. Grunow, 410 Fourth Av., N. Y.	Students' Microscope (horse-shoe base).	Transverse bar.	12	5	$\frac{31}{32}$	Brass.	Sliding tub[e]
T. H. McAllister, 49 Nassau St., N. Y.	Students' Microscope.	Transverse bar.	12	$4\frac{1}{2}$	1	Iron base.	Chain move[-]ment.
T. H. McAllister, 49 Nassau St., N. Y.	Professional Microscope.	Transverse bar.	15	7	$1\frac{5}{16}$	Iron base.	Chain move[-]ment.
Wm. Y. McAllister, 728 Chestnut St., Philad.	(No. 5374.)	Transverse bar.	13	$4\frac{2}{3}$	$1\frac{1}{16}$	Iron base.	Sliding tub[e]
Wm. Y. McAllister, 728 Chestnut St., Philad.	(No. 5374.)	Transverse bar.	13	$4\frac{2}{3}$	$1\frac{1}{16}$	Iron base.	Sliding tub[e]
Miller Bros., 1223 Broadway, N. Y.	Students' Microscope.	Jackson.	16	5	$1\frac{1}{4}$	Iron base and arm.	Sliding tube in cloth.
Miller Bros., 1223 Broadway, N. Y.	Educational Microscope.	Transverse bar.	15	4	$1\frac{3}{16}$	Brass.	Rack and pinion.

* R. B. Tolles, superintendent.

† Arm expands to fill whole space between uprights, and gives, with conical steel pin, a very simple Trunnion joint.

...e ad-...ment.	Stage.	Mirror.	Ocular	Objectives	Range of magnifying powers	Accessory apparatus.	Price with case (in dollars).	Price of cheapest binocular stand only (in dollars).
...rew to ...tage.	Plain, with spring clips.	Concave, 1½ in., with side movement.	1½ in.	1 in. & ¼ in.	75 to 300.	Mirror to separate stand for opaque illumination.	50.	80., *extra* for binocular eye-piece.
...ew with lever to nose-piece.	Plain, with fitting for accessories.	Plane and concave, 1½ in., with side movement.	1½ in.	1 in. & ¼ in.	75 to 450.	Mirror to separate stand for opaque ill., draw-tube & camera lucida.	100.	80., *extra* for binocular eye-piece.
...ew to ...pound ...y.	Plain, with spring clips‡.	Plane and concave, 1½ in., with hinge movement.	Two.	⅔ in. 25° and ⅕ in. 90°	70 to 500.	None.	85.	None.§
...ew to ...pound ...y	Plain, with spring clips‡.	Plane and concave, 1½ in., with hinge movement.	Two.	⅔ in. 25° and ⅕ in. 90°	70 to 500.	Camera lucida, stage micrometer & compressorium.	100.	None.§
...ew to ...ge.	Plain, with spring clips.	Plane and concave, with hinge movement.	B	1 in. & ¼ in. (French.)	50 to 400.	Draw tube and stage forceps.	50.	None, at present.
...w with lever to nose-piece.	Glass, sliding by hand.	Plane and concave, with hinge movement.	A & B	1 in., ½ in. & ¼ in.	50 to 600.	Draw tube and stage forceps.	100.	None, at present.
Screw with lever to compound body.	Glass, sliding by hand.	Concave, with hinge movement.	Two.	One set of Fr., dividing.	50 to 350.	Condensing lens on stand.	50.	None.
Screw with lever to compound body.	Glass, sliding by hand.	Concave, with hinge movement.	Two.	$\frac{4}{10}$ in. 32°, & ⅕ in. 120°. (Zentmayer.)	50 to 430.	Condensing lens on stand, camera lucida stage micrometer, & animalcule cage.	100.	None.
Screw to stage.	Plain, with spring clips.	Concave, with hinge movement.	A & B	1 in. 16° and ¼ in. 75°	37 to 310.	Mirror to stage for opaque ill.	60.	100.
...ew with lever to nose-piece.	Plain, with spring clips.	Concave, 1½ in., with side movement.	A & B	1 in. 16° and ¼ in. 75°	37 to 310.	Stage plates & condensing lens on stand.	80.	100.

‡ Diaphragm, sunk into upper surface of stage, so as to be close to the object slide.
Makes optical parts, to work with Zentmayer's binocular hospital-stand.

Table of American Micros

Name and address of maker.	Name of instrument.	Model.	Height (in inches) with high powers.	Weight (in lbs.)	Inside diameter of tube (in inches).	Material (brass except as stated).	Coarse ad-justment
B. Pike's Son, 518 Broadway, N. Y.	Students' Microscope.	Jackson.	15	5	$1\frac{3}{8}$	Iron base and arm.	Rack a pinion.
B. Pike's Son, 518 Broadway, N. Y.	Physicians' Microscope.	Jackson.	15	5	$1\frac{3}{8}$	Iron base.	Chain mo ment.
Jas. W. Queen & Co., 924 Chestnut St., Phil., and 535 Broadway, N. Y.	Students'‖ Microscope. (No. 1665).	Jackson.	14	5	$1\frac{3}{8}$ (scant).	Iron base and arm.	Sliding tu
Jas. W. Queen & Co., 924 Chestnut St., Phil., and 535 Broadway, N. Y.	Students'‖ Microscope. (No. 1665).	Jackson.	14	5	$1\frac{3}{8}$ (scant).	Iron base and arm.	Sliding tub
Chas. A. Spencer & Sons, Canastota, N. Y.	Students' Microscope.	Jackson.	15	6	1.18	Iron base and arm.	Sliding tube in velvet.
Chas. A. Spencer & Sons, Canastota, N. Y.	Students' Microscope.	Jackson.	15	6	1.18	Iron base and arm.	Rack an pinion.
Chas. A. Spencer & Sons, Canastota, N. Y.	Standard Microscope.	Jackson.	17	11	1.18	Iron base and arm.	Rack an pinion.
Wm. Wales,¶ Fort Lee, N. J.							
J. Zentmayer, 147 South 4th St., Philadelphia.	Students' Microscope. (Roundbase.)	Jackson.	15	$5\frac{1}{2}$	$1\frac{3}{8}$	Brass.	Sliding tube
J. Zentmayer, 147 South 4th St., Philadelphia.	Students' Microscope. (Roundbase.)	Jackson.	15	$5\frac{1}{2}$	$1\frac{3}{8}$	Brass.	Sliding tub

‖ Accessories of Beck's "popular" stand fit this.
¶ Makes optical parts only, to stands by any maker.

Continued.

Fine adjustment.	Stage.	Mirror.	Oculars.	Objectives.	Range of magnifying powers.	Accessory apparatus.	Price with case (in dollars).	Price of cheapest binocular stand only (in dollars).
Screw with lever to stage.	Glass, sliding by hand.	Plane and concave.	A & B	1 in. & $\frac{1}{8}$ in. (Gundlach).	50 to 600.	Condensing lens on stand.	75.	125.
Screw with lever to compound body.	Glass, sliding by hand.	Plane and concave.	A & B	1 in. & $\frac{1}{8}$ in. (Gundlach).	50 to 960.	Condensing lens on stand, & draw tube.	100.	125.
Screw with lever to nose-piece.	Glass, sliding by hand, with fitting for accessories.	Plane and concave, with hinge movement.	A.	$\frac{1}{5}$ in. (dividing).	100 to 300.	Stage micrometer and condensing lens on stand.	60.	None.
Screw with lever to nose-piece.	Glass, sliding by hand, with fitting for accessories.	Plane and concave, with hinge movement.	A & B	1 in. 18° and $\frac{1}{5}$ in. 80°	50 to 500.	Stage micrometer, condensing lens on stand, camera lucida & compressorium.	100.	None.
Screw to stage.	Plain, with spring clips.	Plane and concave, 1½ in., with hinge movement.	B	1 in. 20° and $\frac{1}{4}$ in. 60° adj.	85 to 325.	Mirror on curved arm to swing above stage for opaque ill.	60.	None.
Screw with lever to nose-piece.	Plain, with spring clips.	Plane and concave, 1½ in., with hinge movement.	B	1 in. 20° and $\frac{1}{4}$ in. 60° adj.	85 to 325.	Mirror on curved arm as above, camera lucida and animalcule cage.	100.	None.
Screw with lever to nose-piece.	Plain, with spring clips.	Plane and concave. 2 in., with hinge movement.	B	$\frac{1}{4}$ in. 60° adj.	325.	Mirror on curved arm as above.	100.	None.
Screw to stage.	Plain, with spring clips, and tube for accessories.	Plane and concave, 1¾ in., with hinge movement.	A & B	$\frac{8}{10}$ in. 22° and $\frac{1}{5}$ in. 85°	50 to 430.	Condensing lens to limb.	75.	135.
Screw to stage.	Plain, with spring clips, and tube for accessories.	Plane and concave, 1¾ in., with hinge movement.	A & B	$\frac{8}{10}$ in. 22° and $\frac{1}{5}$ in. 85°	50 to 430.	Condensing lens to limb, camera lucida, stage micrometer, & compressorium.	90.	135.

HIBERNATION OF THE JUMPING MOUSE.

BY PROF. SANBORN TENNEY.

On the 18th of January of the present year (1872), I went with Dr. A. Patton of Vincennes, Indiana, to visit a mound situated about a mile or a mile and a half in an easterly direction from Vincennes. While digging in the mound in search of relics that might throw light upon its origin and history, we came to a nest about two feet below the surface of the ground, carefully made of bits of grass, and in this nest was a Jumping Mouse (*Jaculus Hudsonius* Baird) apparently dead. It was coiled up as tightly as it could be, the nose being placed upon the belly, and the long tail coiled around the ball-like form which the animal had assumed. I took the little mouse into my hand. It exhibited no motion or sign of life. Its eyes and mouth were shut tight, and its little fore feet or hands were shut and placed close together. Everything indicated that the mouse was perfectly dead, excepting the fact that it was not as rigid as perhaps a dead mouse would be in the winter. I tied the mouse and nest in my handkerchief and caried them to Vincennes. Arriving at Dr. Patton's office I untied my treasures, and took out the mouse and held it for some time in my hand; it still exhibited no sign of life; but at length I thought I saw a very slight movement in one of the hind legs. Presently there was a very slight movement of the head, yet so feeble that one could hardly be sure it was real. Then there came to be some evidence of breathing, and a slight pressure of my fingers upon the tail near the body was followed by an immediate but feeble movement of one of the hind legs. At length there was unmistakable evidence that the animal was breathing, but the breathing was a labored action, and seemingly performed with great difficulty. As the mouse became warmer the signs of life became more and more marked; and in the course of the same afternoon on which I brought it into the warm room it

Fig. 101.

Jumping Mouse (*Jaculus Hudsonius* Baird.)

became perfectly active, and was as ready to jump about as any other member of its species.

I put this mouse into a little tin box with holes in the cover, and took him with me in my journeyings, taking care to put in the box a portion of an ear of corn and pieces of paper. It ate the corn by gnawing from the outside of the kernel, and it gnawed the paper into bits with which it made a nest. On the fourth day after its capture I gave it water which it seemed to relish. On the 23d of January I took it with me to Elgin, Illinois, nearly three hundred miles farther north than the region where I found the specimen. The weather was intensely cold. Taking the mouse from the box, I placed it on a newspaper on a table, and covered it with a large glass bell, lifting the edge of the glass so as to admit a supply of air. Under this glass was placed a good supply of waste cotton. Soon after it was fairly established in its new and more commodious quarters, it began to clean every part of its body in the most thorough manner, washing itself very much in the same manner as a cat washes. On coming to the tail it passed that long member, for its whole length, through the mouth from side to side, beginning near the body and ending at the tip. At night as soon as the lights were put out the mouse began gnawing the paper, and during the night it gnawed all the newspaper it could reach, and made the fragments and the cotton into a large nest perhaps five or six inches in diameter, and established itself in the centre. Here it spent the succeeding day. The next night it was supplied with more paper, and it gnawed all it could reach, and thus spent a large part of the night in work. I could hear the work going on when I was awake. In the morning it appeared to be reposing on the top of its nest; but after watching it for some time, and seeing no motion, I lifted up the glass and took the mouse in my hand. It showed no signs of life. I now felt that perhaps my pet was indeed really dead; but on remembering what I had previously seen, I resolved to try to restore it again to activity. By holding it in my hand and thus warming it, the mouse soon began to show signs of life, and although it was nearly the whole day in coming back to activity, at last it was as lively as ever, and afterward, on being set free in the room, it moved about so swiftly by means of its long leaps, that it required two of us a long time to capture it uninjured.

On the evening of February 6th I reached my home in Williams-

town, and on my arrival the mouse was in good condition. But the next morning it was again apparently dead; in the course of the day, however, being placed where it was warm, it gradually came back again to activity as before.

This mouse, then, when dug from the mound was in a state of the most profound lethargy, — if torpidity be too strong a term, — and it is safe to infer that it would have so remained till spring, had it not been removed into a warmer temperature; and this lethargy or torpidity was as intense, so far at least as regards external appearances, as that seen in other animals, not excepting reptiles and batrachians.

I may add that the observations above detailed show that this mouse is capable of passing into the deepest lethargic state in a single night, and of returning, when warmed, to activity again on the succeeding day.

The Jumping Mouse is very quiet in the daytime, but very active at night. When disturbed in its nest it vigorously repels the attack by striking with its fore feet with the greatest rapidity. It apparently does not seek to bite me.

Since the above was written the mouse has repeated the exhibitions detailed above, and at least once since the beginning of April. A colder night than usual seems to furnish the occasion for it to go into a state of the most profound lethargy.

THE WHITE COFFEE-LEAF MINER.

BY B. PICKMAN MANN.*

THE observations upon which I base the following history of that insect (*Cemiostoma coffeellum*) which is the greatest enemy to the coffee-culture of Brazil, were made in the autumn and winter of the year 1871, at the fazendas of São Sebastião and Secretario, in the township of Vassouras, Province of Rio de Janeiro, Brazil.

At São Sebastião, to whose owner, my esteemed friend Sñr. Lindorf Moreira de Vasconcellos, I return my most heartfelt

* A Report as Entomologist to the Government of Brazil.

thanks for his unbounded hospitality and kindness, my observations extended through the greater part of the month of March.

At Secretario I continued my observations until the latter part of June, aided by the sympathy and coöperation of the proprietor, Dr. Christovão Corrêa e Castro, one of the most enlightened and progressive men whom I had the pleasure of knowing in Brazil.

The acknowledgment of my deep gratitude is due also to Col. Antonio Corrêa e Castro for his tender care of me during a month when I was prostrated by severe sickness.

I have arranged my account of the insect under headings, for greater convenience to the future investigator, and have added an explanation of the less familiar words used, for the benefit of those who are not acquainted with the science of entomology.

Food-plant, and Indications of the presence of the Insect.—The caterpillar (larva) lives in the leaves of the coffee-tree (*Coffea Arabica*), where the injury done by it is shown by the presence of rust-colored blotches on the upper surface of the leaf. These blotches are sometimes almost black in the centre.

After the larva has stopped feeding, and changed to a chrysalis (pupa), the slender, white chrysalis-case (cocoon) covered with its silken web may easily be found in a fold of the leaf.

The moths (imagos) whose beautifully ornamented, silvery wings hardly cover the breadth of the little finger nail, rest upon the leaves and branches of the tree when quiet, but are easily disturbed. Then they fly actively with a jerking flight.

Scientific Name.—The name of the genus (*Cemiostoma*) is derived from the Greek words Κημός, meaning *muzzle*, and στόμα, meaning *mouth*, so that it may be translated *muzzle-mouth*. This name was given by Zeller, in the year 1848 (in the "Linnæa Entomologica," vol. iii, p. 273), because the hairs on the side of the face are so long as to cover up the mouth. It should be accented on the antepenultimate syllable. Since it is neuter in gender, because στόμα is neuter, the specific name must be neuter also. The specific name is taken from the scientific name of the food-plant, with a termination indicating the small size of the insect.

Synonyme.—The insect was called *Elachista coffeella* by Guérin-Mèneville in his memoir (to which I shall often refer hereafter), because at the time when he described it, the genus Cemiostoma had not been established, and the genus *Elachista* was still considered of such extent as to include this species.

It was referred to under the same name by Nietner in his pamphlet on the enemies of the coffee-tree in Ceylon.

Vernacular names. — Guérin-Mèneville, who described it as coming from the Antilles, called it " L'Elachiste du Cafier."*

In Brazil it is called "A Borboleta do Cafezal," the coffee-plantation butterfly or moth, but I should think it much more satisfactory to unite accuracy with definiteness by giving it the name of the White Coffee-leaf Miner, because other species of moths are found also living on the coffee-tree, and a black coffee-leaf miner (*Gracilaria? coffeifoliella*) is known in Ceylon.

Erroneous names.— This is probably the insect referred to doubtfully as a Bucculatrix (?) by Stainton in the " Entomologist's Weekly Intelligencer," vol. iv (1858), p. 70.

Imago.—The outspread wings of the perfect insect (imago) measure from tip to tip between four and six millimeters. The body is about two millimeters long. Silvery white scales cover the head and face, the body below, the upper side of the front wings, and the legs, except the tips of the first, second and fourth foot-joints (tarsi), upon the upper side of which the scales are black. In my specimens, which are not in good condition, the upper side of the hind-body (abdomen) is bare and of a yellowish brown color. The antennæ are smoky black, except at the base. The front wings are long in proportion to their breadth. On the upper side of each, at the extremity of the inner edge (inner angle) is a large steel-blue or black spot, which has a violet lustre. This spot is bordered on the sides towards the base and front edge of the wing by a golden-yellow band, which is continued toward the end of the wing. At more than half the distance from the base of the wing to the tip, arises from the front edge (costa) another golden-yellow band, with converging sides, bordered on each edge with black scales, which runs obliquely toward the black spot, and sometimes almost reaches the golden edging of that spot. Beyond an interval of about the width of this band nearer the tip of the wing (apex) arises another band of the same color, but wider and shorter, and bordered only on the inside with black scales. This band runs less obliquely toward the black spot, but does not meet the other bands. About as far beyond the second band as that is beyond the first, a line of black scales arises

* The effect upon the leaves was called "rouille" (rust), by the people of the country, who did not know to what it was due, and ascribed it to the action of the sun.

from the costa, and runs obliquely to a point at some distance beyond the black spot. Still nearer the end arises another line of black scales, which runs less obliquely, and meets the former at its termination, the two thus forming an acute angle. The inner and outer edges of the front wings, and the whole circumference of the hind wings bear long smoky-black or brown fringes. The hind wings are very narrow and pointed. They are smoky-black on both the upper and under sides.* The front wings are of the same color on the under side. From the front of the head projects a spreading tuft of silvery-white hairs. The scales behind this tuft lie smoothly back on the head. The antennæ are about three-fourths as long as the front wings, and thread-like. Their basal joints are thickly clothed with silvery hairs, which form a velvety eye-cap as large as the eyes. The eyes are black.

Pupa.— The chrysalis (pupa) is two millimeters long; of a yellowish brown color. The head is large; the eyes are black; the limbs are glued to the body; the last pair of legs extends very little beyond the tip of the abdomen. It appears to me that eight abdominal segments are visible.

Cocoon.— The cocoon is five millimeters long, slender, spindle-shaped, formed of threads of silk of a white color, which are laid lengthwise and close together upon the outside. It is open at each end with a longitudinal slit. It rests upon a flooring of silk, and is covered by a light web of white silk, which is spun across one of the furrows at the edge of a leaf. This web is a little broader at each end than in the middle, and has an opening in each end shaped like the point of a lance, through which openings the ends of the cocoon beneath may be seen.

Larva.—The caterpillar (larva) is four or five millimeters long, and seventy-five hundredths of a millimeter broad across the first ring (prothorax), which is the widest part. It is of a yellowish flesh color, partially transparent. It is flattened, and consists of twelve rings (segments) behind the head, between each of which the body is much constricted. The second and third segments (which, with the first, form the thorax,) are successively narrower than the segment in front of them; the next three segments are successively broader, and the rest of the segments (which, with the three before them, form the abdomen), are successively nar-

*Guérin says (Mém. etc., p. 15) that they are covered with silvery scales like the superiors.

rower to the end. The head is flat, rounded in front, and is frequently much retracted within the prothorax, when its lobes show through the skin of the prothorax. The jaws (mandibles) have three teeth at the end,* and are covered in repose by the upper lip (labrum). The head on each side, has two eye-spots (ocelli), of which the anterior is the larger, and about nine hairs. The three segments of the thorax bear each a pair of jointed legs; the third, fourth, fifth, sixth and ninth or last segment of the abdomen bear each a pair of fleshy projections which serve as feet, so that the larva may be considered as sixteen-legged. From each side of the back of each abdominal segment, arise three hairs, of which the anterior or shortest is directed forward, while the two others are directed backward. The third hair is twice or more than twice as long as the second, being nearly equal in length to the breadth of the segment. The thoracic segments have all three hairs directed forward; the second hair is the longest, and an additional hair arises from the outer edge of the back of each segment.

The mine.— The habitation of the larva is a mine, which is made in the leaf by eating out the soft green substance (parenchyma) between the upper skin (epidermis) and the framework of the leaf, laying the framework bare, but leaving the epidermis intact, except at the point where (I suppose) the larva enters the leaf. At this point the wound heals up and forms a lenticular scar twenty-five hundredths of a millimeter in length, and fifteen hundredths of a millimeter in breadth, raised a little above the general surface of the leaf. The epidermis which covers the mine becomes rusty brown, sometimes almost black in the centre. The excrement (frass) adheres irregularly to its under surface. Sometimes a portion of the under surface of the leaf opposite the mine also turns brown.

When the eggs are laid in sets, as hereafter to be described, the mines of the separate larvæ usually become united, and even the mines of two sets may be united into one.

One mine fifteen millimeters long and ten millimeters broad, contained seven larvæ, the scars arranged in two groups of four and three respectively. Another scar was near.

As many as five mines, all inhabited, have been found on one leaf and even eight mines made by ten larvæ, though in this case some of the larvæ had escaped.

* Guérin says (Mém. etc., p. 13) that they are bidentate.

When the larva escapes, it cuts an angular or rounded slit in the epidermis near an edge of the mine. This slit is slightly more than one millimeter across, about one and five-tenths millimeters long.

The eggs.— Before I had seen any of the insects, I was shown some eggs on a coffee-leaf, which were said to be the eggs of this moth. I was not able to describe them at the time, but I think they could not have belonged to this moth, because they seemed too large. Stainton says, however (Nat. Hist. Tin., i, 324), that the eggs of *C. scitellum*, which is in its habits one of the nearest allies of this species, are disproportionately large for the size of the insect. Guérin does not describe the eggs in his memoir.

Classification. — It belongs to the suborder of scaly-winged insects (Lepidoptera), which may be known from other winged insects because their wings are more or less covered with scales, which lap over each other like tiles on the roof of a house, and further they (in the imago state) have no visible jaws, but either have a tubular tongue formed of two similar pieces which can be rolled up like a watch-spring, or have no means of taking food.

It belongs to the tribe of cloth-worm moths (Tineina), which are all of small size, and may be known from the other Lepidoptera because their wings, which are elongated, are not split, but are fringed with long hairs.

According to Zeller (Linn. Entom., iii (1848), p. 250), the only Tineina whose larvæ make mines in leaves, and whose imagos have the head covered with entirely smooth scales, and have the lower joints of the antennæ widened into an eye-cap, are included in the genera Cemiostoma and Phyllocnistis. These genera with others, were considered by Stainton (I know not in what work) to form the family of Lyonetia moths (Lyonetidæ). The genus Cemiostoma, to which our insect belongs, is distinguished from the genus Phyllocnistis by the absence of tongue-shields (palpi) (l. c., p. 250), and by the middle area (cell) of the fore wings not being closed (l. c., p. 265).

The genus *Cemiostoma* was divided by Stainton (Nat. Hist. Tin., i, 288) into two groups, one of which has the anterior wings of the perfect insect white, while the other has these wings leaden-gray. The former of these groups, to which our species belongs, contains six species, as far as known at present. These are *C. susinellum*, *spartifoliellum*, *wailesellum*, *coffeellum*, *labur-*

nellum and *zanclœellum*. *Cemiostoma coffeellum* is the only species of the genus yet known outside of the limits of Europe.

Our species may be known from the other species of the group by the following characters: *C. zanclœellum* has not the first golden band on the costa; in *C. susinellum* this band extends across the wing, reaching the inner angle; in *C. laburnellum*, *spartifoliellum* and *wailesellum*, this band hardly reaches to more than half the distance from the costa to the black spot, and the second band is bordered on *both* edges by dark scales. Further, all the species of the group, except possibly *C. zanclœellum*, have two or three fuscous streaks on the fringe, radiating from the black spot. I can discover no such streaks in this species.

I do not find it recorded that any other species of the group, except *C. laburnellum*, breeds more than once in a year. Stainton says (Nat. Hist. Tin., i, 314) that *C. laburnellum* breeds twice.

Seasons.—The larvæ are said to attack the new leaves in early spring, and to be found from that time forth. As the coffee-tree is evergreen, it seems likely that the period of hibernation is very short or none at all. Guérin says (Mém. etc., p. 16) that the insect occurs throughout the year in the Antilles, but is more or less abundant according to the seasons.

The eggs which I have mentioned were seen on the twenty-fifth of January. The planter who showed them to me said he had seen the moths that day. I found the larvæ, pupæ, and imagos from the ninth of March until my observations ended on the twenty-first of June.

Periodicity.—Guérin says (Mém. etc., pp. 17, 43) that the eggs hatch seven or eight days after being laid. The larvæ then live about fifteen or twenty days within the leaf, after which they make their cocoons. The cocoon is spun within less than twenty-four hours after the larva has left the mine. The larva-skin is thrown off within twenty-four hours after the cocoon is completed. I did not observe how long the pupa-state continues. According to Guérin (Mém. etc., p. 13, 17), the imago comes out of the cocoon at the end of six days. It is not known how long it lives. I should judge that it lived less than two weeks, as that has been noticed to be the probable limit of life in *C. scitellum* (Entom. Monthl. Mag., iv (1867), p. 162).

The history of reproduction, and of the deposition of eggs is not known. It must have an important effect upon the longevity

of the sexes. Guérin says (Mém. etc., p. 17), that the insect is reproduced several times in the year, in the Antilles, once in about every forty to forty-eight days. This would allow for the Eggs, 7 to 8 days; Larva, 15 to 20 days; Pupation, 2 days; Pupa, 6 days; Imago, 10 to 12 days; total, 40 to 48 days.

Habits of the larva.—As soon as the larva is hatched (if I mistake not), it cuts through the upper epidermis of the leaf, and begins to eat the parenchyma. Usually it may be found under an edge or an end of the blotch, eating. I found no cast skins in the mines. The larvæ can not be considered social, although several are often found in one mine when several mines have become united. They show no signs of pugnacity or mutual destructiveness. When the larva is full-grown it escapes from the mine, and often, or even generally, goes to another leaf to make its cocoon. This it can do by letting itself drop with a thread of silk. It then makes its cocoon across one of the furrows at the edge of a leaf, on either the upper or the under surface, but oftener on the under surface. The larva places itself across the furrow, and begins a web by spinning a series of threads from one side to beyond the middle of the furrow, swinging the fore part of its body back and forth sidewise. When it has made one side of one end of its web thus, it spins a like series of threads to make the other side, without changing the position of the hind part of its body. Thus an opening is left in the middle of this end of the web, in the space occupied by the body of the larva. It then turns around, and places its body across the furrow in the opposite direction. Here it spins a like series of threads on each side of it, from the leaf to the former part of the web, leaving a similar opening in this end. It then retires beneath the web, and lays a flooring of silk. On this flooring it spins its cocoon, laying the outside threads lengthwise.

The cocoons are found in the greatest abundance on the leaves which are near the ground, and frequently on leaves which have never been injured.

Habits of the Pupa.— The larva-skin is split *longitudinally* over the middle line of the head and first two thoracic segments. The split extends from the very foremost extremity of the head to the third thoracic segment (*metathorax*), but does not enter this latter. For the certain observation of this fact, and of the manner in which the pupa-skin is burst, I am indebted to Dr. Hagen,

who pointed out to me these interesting details. The skin is then thrown off and pushed out through the posterior end of the cocoon.

Habits of the Imago.—The pupa-skin is split transversely across the back of the head (*vertex*) then longitudinally along the sides of the thorax as far as the metathorax. When the imago emerges, the pupa-skin is left inside of the cocoon, generally I think, but in some cases I have found it protruding from the anterior end of the cocoon, through which the imago escapes by pushing aside the threads. It rests on or under the leaves or branches, but is easily disturbed. "It is very lively and very agile," as Guérin says (Mém. etc. p. 16) "and flies in all directions seeking to copulate. It is seen to execute rapid bounds, and its jerking flight makes it known even at a distance." It flies in the day-time, perhaps also in the night-time.

I judge from the appearance of the scars in the epidermis, already described, that the eggs are laid unconcealed on the upper surface of the leaf, singly, or in sets of two, three or more, but not in immediate proximity, and that sometimes two or more sets are placed on the same leaf. It is not known how many eggs are laid by one female.— *To be continued.*

EXPLANATION OF PLATE 5.

FIG. 1. Imago of *Cemiostoma coffeellum*, magnified 15 diameters.

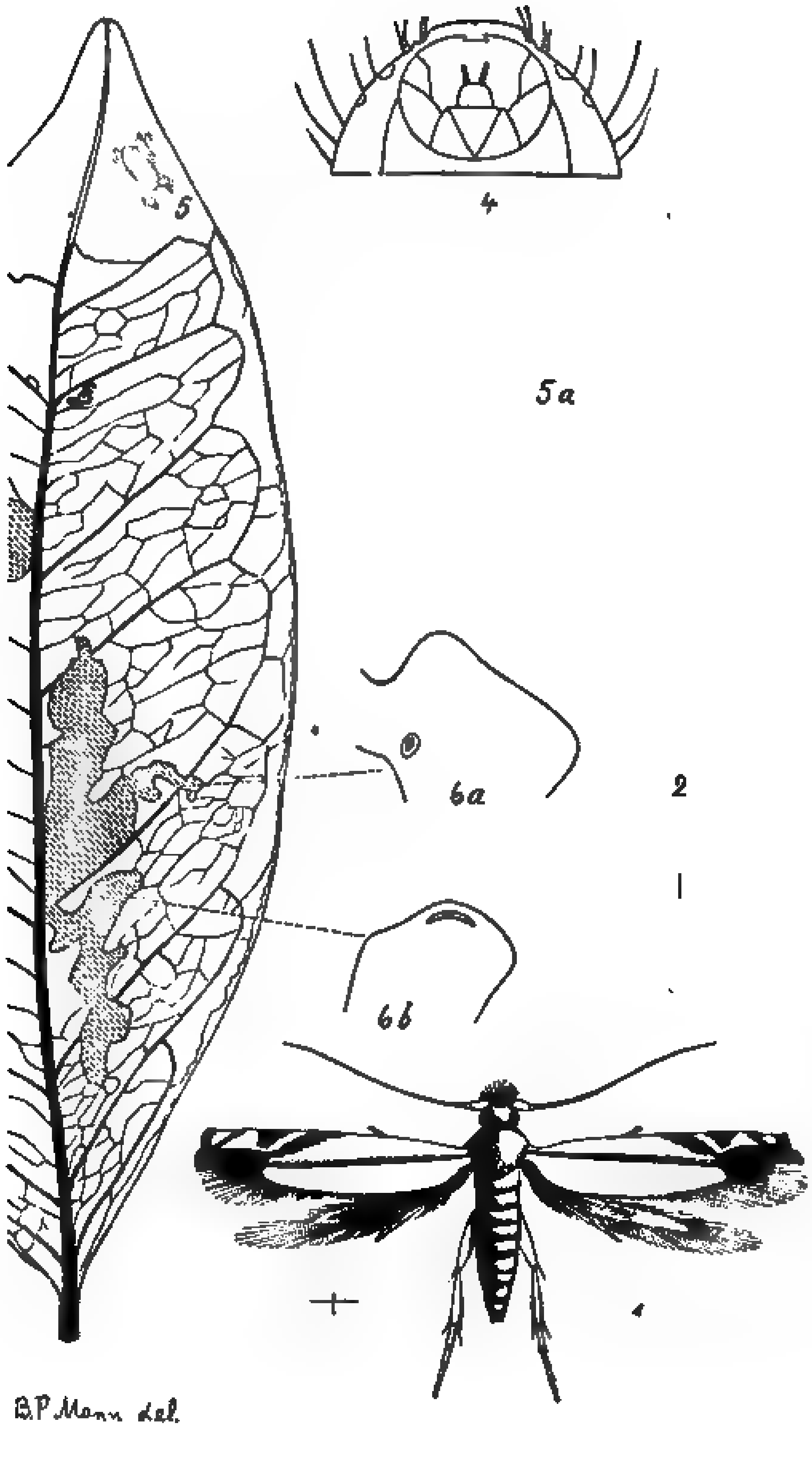
FIG. 2. Empty pupa-skin of the same, seen from beneath, magnified about 20 diameters. (The projections near the head are the broken sides of the thorax.)

FIG. 3. Larva of the same from above; the head retracted, magn. 15 diameters.

FIG. 4. Head of the larva from below, showing some of the mouth-parts, magnified about 60 diameters.

FIG. 5. Cocoon of the same, natural size; *5a*, the same magnified 3 diameters.

FIG. 6. Leaf of coffee tree natural size, containing five mines made by ten larvæ, five of the larvæ belonging in the four mines wholly figured; *6a*, part of a mine magnified 10 diameters to show the scar made by the larva in entering the leaf; *6b*, part of a mine magnified 5 diameters to show the slit made by the larva in leaving the mine.


4
5
5a
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2
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ORNITHOLOGICAL NOTES FROM THE WEST.

BY J. A. ALLEN.

II. NOTES ON THE BIRDS OF COLORADO.

COLORADO TERRITORY embraces portions of two very different geographical regions, its eastern half consisting of plains and its western being exceedingly mountainous, including several of the highest peaks of the Rocky Mountain system. These two regions are as diverse faunally as they are in physical features. The ornithological character of the eastern half of the territory differs little from that of the adjoining portions of Kansas, already briefly noticed in the NATURALIST for May, p. 263. On entering the mountains, however, one immediately meets with many species of birds not seen on the Plains, whilst only a few of those characteristic of the Plains are found in the mountain district, and these only in the broad valleys or "Parks" which repeat most of the characteristic features of the Plains. Owing to the prevalence of forests and the highly diversified character of the surface in the western district, the number of species of birds found within it greatly exceeds that of the eastern, there being in western Colorado in the breeding season rather more than the average number of species found during the same season in an equal area of any portion of the wooded region to the eastward of the Mississippi River, and more than twice the number found in corresponding areas on the Plains.

As would naturally be expected, we already find in the narrow timber-belts that extend down from the mountains along the streams for a short distance into the Plains a few of the species characteristic of the mountains; just as on the eastern border of the Plains many of the forest birds of the eastern portion of the United States follow up the stream to the farthest limit of arboreal vegetation. On entering the foothills, however, we are fairly within the mountain fauna; and as we advance westward to the more elevated valleys, and thence to the timber line of the Snowy Range, we gradually meet with new forms and lose sight of some that were among the most numerous near the eastern base of the mountains.

The observations herein detailed, were made during a journey from Denver through the mountains to South Park, by way of the usual stage road to Fairplay, and thence up the South Platte to Mount Lincoln. Retracing our steps to Fairplay, we struck eastward across the Park to the eastern spurs of the main chain, crossing these near the northern base of Pike's Peak to Colorado City, and thence to Denver along the western edge of the Great Plains The journey occupied about five weeks, and, as we left Denver July 6th, was chiefly made during the nesting season of the birds. We entered the foothills at a point about fifteen miles southwest of Denver, where Bear Creek emerges from the mountains and enters the Plains. Leaving immediately this stream, however, we crossed a low divide and struck Turkey Creek, and for many miles wound along its wild cañon up into the mountains. We afterwards crossed another divide and reached the North Fork of the South Platte River, and continuing our southwesterly course, through valleys and over moderate heights, finally entered South Park at its northeastern extremity, by a pass about ten thousand feet above sea-level. The vegetation of the foothills was scanty, and the hills themselves sparsely wooded, the aridity of the climate along the eastern base of the mountains being nearly as great as that of the adjoining plains. Along Turkey Creek rain in summer is evidently far more frequent than to the eastward, the country here being well forested. The slopes of the mountains are heavily clothed with different kinds of pines and spruces, whilst the streams are densely fringed with willows, alders, and several small species of poplars and birches. Here thousands of bright flowers everywhere dot the valleys, so that with the picturesqueness of the scenery, the beauty of these mountain glens is doubtless rarely equalled elsewhere on the continent. Here also is a spot of fascinating interest to the ornithologist; this immediate region being apparently one of the richest in bird-life to be found in this part of the Rocky Mountains.

Passing on to the North Fork of the South Platte, we find a somewhat less varied fauna and flora, we having left behind us many species of both the birds and flowers that made Turkey Creek valley so attractive. Here and there the valley of the North Fork spreads out into broad grassy bottom-lands, which are already the homes of enterprising mountaineers, whose rude log-cabins one meets with unexpected frequency. Further on, the

mountains are still less heavily wooded, with here and there wide grassy openings; the flowers are less numerous, the animal life less var'ed, the birds especially being notably scarcer, whilst everywhere there are evidences of a rather arid climate. South Park itself is almost as arid as the Plains, with much the same vegetation and general aspects, representing, in fact, the Plains in miniature.

Following along the northern edge of the Park we pass Fairplay and follow up the valley of the South Platte to its source at the northern base of Mount Lincoln. The Platte valley above Fairplay is again a moister region, with a richer flora and fauna and with the declivities of the hills heavily wooded. The abundance of large bright flowers is again a conspicuous feature, even to considerably above timber line, the grassy slopes far above the limit of the coniferous vegetation being thickly set with flowers of richest tints, even at altitudes exceeding thirteen thousand feet. Camping a week near the eastern base of Mount Lincoln, at the old mining town of Montgomery, and making excursions to the tops of the neighboring peaks, we then retraced our steps to Fairplay, and continued thence eastward across South Park to the eastern spurs of the mountains. These spurs we find are irregularly wooded, with frequent grassy intervals of considerable extent, forming a series of little Parks. There is not much that is attractive in the scanty vegetation, and birds and animals of all kinds are scarce, the country being again comparatively arid. In the valley of the North Fork oats and potatoes of the finest quality are raised, though liable to injury from frosts, but the dryness of the climate in and about South Park, though a milder region, renders irrigation necessary for the production of grains and vegetables. It is nevertheless an excellent grazing country, stock wintering well here, as in fact in all the principal mountain valleys, gathering their own subsistence in winter as well as in summer. From Colorado City to Denver our road led quite near to the foothills. The streams were well fringed with willows and cottonwoods, with here and there detached and rather open patches of coniferous forest on the ridges, as well as occasionally adjacent to the streams; hence we have here, as previously remarked, a commingling of the birds of the mountains with those of the Plains.

With this meagre sketch of the country traversed we can now

more intelligently return to the birds. Among the more common birds that one meets with along the streams of the western edge of the Great Plains are such familiar eastern species as the kingbird, catbird, brown thrush, and the Baltimore and orchard orioles, all of which appear to find their western limit in Colorado at the base of the Rocky Mountains, though further north some of them range nearly or quite across the continent. Of other species characteristic of the western edge of the Plains are many that occur not only eastwardly to the Atlantic, but also westward to the Pacific, as the robin, yellow warbler (*Dendrœca æstiva*) the cliff, barn, white-bellied and rough-winged swallows, the meadow lark, house wren, yellow-breasted chat, nipping, field, Lincoln's, and bay-winged sparrows, the black-capped titmouse, red-winged blackbird, red-headed woodpecker, Carolina dove, kingfisher, yellow bird or goldfinch, marsh and sparrow hawks, the killdeer plover and spotted sandpiper, nearly all of which were seen more or less frequently throughout most of our journey in the mountains, as well as at their eastern base. The loggerhead shrike was occasionally seen as were also such common species of the Plains as the lark finch, lark bunting, black-headed grosbeak, mountain plover and Arkansas flycatcher, all except the loggerhead being exclusively western species. Say's flycatcher was common near the mountains; the western solitary vireo (*Vireo plumbeus* Coues), the western wood pewee, an *Empidonax*, and the warbling vireo were all frequent, and were met with occasionally in the mountains up to about ten thousand feet. The horned lark was abundant at all favorable localities up to about the same altitude, above which no localities such as it usually frequents were met with. The mountain mockingbird was not only present here, but was also observed at a considerably greater altitude. Of the western forest birds, Audubon's warbler, the violet-green swallow, the arctic bluebird, the arctic towhe, the green-tailed or Blanding's finch (*Pipilo chlorurus*) the western indigobird or lazuli finch, Lewis's woodpecker, Woodhouse's and the great-crested jays, Brewer's blackbird, the magpie and raven, were all more or less common, but far more so in the foothills than on the plains.

All the above named birds were met with in the vicinity of Denver, or on the journey between Colorado City and Denver. Entering the mountains many of them become much more frequent. Among the foothills the common redstart was also common. The

chestnut-backed snowbird (*Junco caniceps*) was first seen at about seven thousand feet, above which it was common to about the timber line. Near this point (seven thousand feet) the white crowned sparrows, the black-capped flycatching-warbler (*Wilsonia pusilla*), Macgillivray's warbler, the pigmy nuthatch and the yellow-bellied woodpecker also first became common, as did also Nuttall's whippoorwill, though the latter doubtless ranges down to the base of the foothills. It was near this point that the arctic towhe, the lazuli finch, the catbird, yellow-breasted chat, black-headed grosbeak and brown thrush disappeared. The violet-green swallow, the American ouzel, the broad-tailed humming bird, the pine finch and the rock wren, though essentially birds of the mountains, were all more or less common among the foothills, and were even seen several miles out on the Plains.

As already remarked, we found Turkey Creek valley richer in birds than any other part of the mountains we visited. Along its upper part, and on the north fork of the South Platte, Macgillivray's warbler was one of the birds most frequently observed, and, excepting Audubon's warbler, which was only moderately frequent, was the only warbler noticed. It was everywhere common along the streams, keeping generally concealed among the willows, its song being very sweet and attractive. Blanding's finch was equally numerous, and its peculiar song was fully as pleasing. It in no respect resembles the eastern towhe, with which and its allies it is associated by systematic writers, far more resembling the group of sparrows so familiarly represented at the East by the white-throat, than any other group—resembling these in its habits, song and general aspect, and from which it differs chiefly in its relatively longer tail. The chipping sparrow was frequent, and we occasionally met with little parties of the chestnut-backed snowbird, which in notes, habits and general appearances so nearly resembles the common eastern snowbird as to be scarcely distinguishable from it when a few yards distant. The great crested jay (*Cyanura macrolopha*), was everywhere conspicuous, and though so different in color and other features, forcibly reminds one of the eastern bluejay, being fully as restless and noisy. The magpie, though less frequent and more wary, was scarcely less prominent, possessing many of the ways and the garrulousness of its near allies, the jays. Lewis's woodpecker was perhaps the most numerous of the *Picidæ*, though the red-shafted and red-headed were common, as

were also the hairy and yellow-bellied. Lewis's differed considerably from the others in habits, rising into the air almost vertically to a great height, apparently in pursuit of insects, descending again as abruptly to repeat soon the same manœuvre. The specimens of hairy woodpecker taken by us represented typically the form known as Harris's woodpecker, which differs from the eastern form in being darker, with fewer of the rounded white spots on the wings. The plumage of the old birds was much worn and very ragged and the white of the belly deeply stained with dusky, but the full-grown young were as white below as in the eastern form, showing the dusky color of the old birds on these parts to be the result of stains acquired from the fire-blackened trees.

The pigmy nuthatch was also numerous, more resembling in its habits the kinglets and titmice,— like them hunting about the extremities of the branches, hanging head downwards — than the common larger species of the East. It is not only gregarious with those of its own kind, but associates freely with the titmice and the ruby crowned kinglet, all keeping up a lively, social twitter. The violet-green swallow, one of the most beautiful of the Hirundines, was everywhere numerous, breeding in deserted woodpeckers' holes, and far outnumbering all the other Hirundines together. A single specimen of Townsend's flycatcher, a bird somewhat allied to the thrushes, though generally associated with the chatterers, and formerly with the flycatchers, was taken on Deer Creek. Wilson's thrush was observed at intervals, and the hermit thrush was everywhere quite common. The broad-tailed humming bird (*Selasophorus platycercus*), the only representative of the *Trochilidæ*, was excessively numerous, and though somewhat larger and otherwise different from the eastern ruby-throat, might easily be mistaken for it by the casual observer. The shrill whistling of his wings, caused by the excessive attenuation of the outer primaries, is, however, a peculiarity one is sure to notice. Near one of our camps we heard scores of Nuttall's whippoorwills, several of which were dimly seen, but the darkness prevented our making their acquaintance "autoptically." The dusky grouse (*Tetrao obscurus*), apparently common, was the only representative of the grouse family we met with in the mountains, except the white-tailed ptarmigan, soon to be more particularly mentioned. Above eight thousand feet, Lincoln's sparrow was the most abun-

dant representative of the *Fringillidæ*, although the white-crowned was also exceedingly numerous, and both possess very pleasing songs.

In South Park we found the birds far less numerous than we anticipated. In the forests contiguous to it occur most of the species already enumerated, except of course the few whose vertical range is limited to an altitude considerably less than that of the Park. Birds are also numerous along the willow-skirted streams, and many birds are met with among the pines that scantily cover the low ridges by which the generally level surface of the park is diversified. Those properly characteristic of the Park itself number less than a dozen species, and are mainly such as characterize the Plains. The savanna and bay-winged sparrows, the horned lark, lark finch and meadow lark, the killdeer and mountain plovers are by far the most numerous. The savanna sparrow was so abundant on Jefferson Creek, that I killed nearly twenty one morning in an hour's shooting and found several nests. Near Fairplay, where we spent several days, the black-capped fly-catching-warbler (*Wilsonia pusilla*) was the most numerous of the insectivorous species, the willow thickets along the Platte and elsewhere being full of them. An *Empidonax* was also common, as was Richardson's wood pewee. These with a single pair of olive-sided pewees (*Contopus borealis*) were the only representatives of the *Tyrannidæ* met with in or about the Park. The *Empidonax* frequented the same localities as the flycatching warbler, and had the peculiar habit (for a flycatcher of this group) of hiding in the thickets so as to render it difficult to capture, like the Acadian fly-catcher of the East, of which it is its western analogue. Several nests were found, both of this species and the wood pewee. The white-bellied and cliff swallows were common Hirundines, the latter nesting under the eaves of the houses in Fairplay, and the former in woodpeckers' holes. The chestnut-backed snowbird was common, but the white-crowned and Lincoln's sparrow were by far the most numerous of the fringilline birds, as was Brewer's blackbird among the *Icteridæ*, the only other species of this family observed being the common meadow lark. The warbling vireo was the only vireo observed, and this species even was not frequent. The common house wren was abundant, and the red-headed and the beautiful Williamson's woodpeckers (*Sphyrapicus Williamsonii*) were more or less common. We here shot our first

purple finches, and the song sparrow was occasional, being more numerous here than elsewhere on our journey.

The vicinity of mount Lincoln was by far the most interesting locality we visited, where we spent a week in a hasty ornithological reconnoissance of the immediate region, our excursions extending from about twelve thousand five hundred feet above sea-level to the top of Mt. Lincoln, whose bald summit rises to nearly a thousand feet above timber line. About thirty-five species were found ranging up to or above the limit of trees, the most of which were tolerably common. The hermit thrush, Audubon's warbler, the mountain and black capped chickadees, the ruby-crowned kinglet, the chipping and Lincoln's sparrows, the red-shafted, hairy, three-toed and yellow-bellied woodpeckers, the arctic bluebird, the Canada and great-crested jays and the pine finch were all more or less common up to the forest line. The robin, a common bird throughout this portion of the mountains, was met with far above the timber line, and its nest was found within a few hundred feet of the tree limit. The spotted sandpiper and the American ouzel were both seen up to the very source of the South Platte, and a nest of the former found at Montgomery, thirteen thousand feet above the sea. The rock wren was seen among the taluses above timber line, and the purple finch was a common bird at Montgomery. The bay-winged, the savanna and white-crowned sparrows and the chestnut-backed snowbird were all observed for a considerable distance above the tree limit. The white crowned and Lincoln's finches are eminently birds of the higher regions, as above ten thousand feet they appear to outnumber all the other sparrows together. The broad-tailed humming bird already mentioned, continued common to far above timber line, being as much at home among the bright flowers growing on the highest parts of the mountains as in the valleys. The barn, cliff and white bellied swallows were also more or less abundant at the same elevation, but breed of course only lower down in the timber zone. None of the smaller birds were more abundant, excepting perhaps the two sparrows already mentioned, than the little black-capped flycatching warbler, which was more conspicuous, if not absolutely more numerous, among the dwarfed willows and birches above timber line than at lower points, scolding the intruder from almost every bush heap; this little bird being hence eminently an alpine species. Among the snow fields of the higher

parts of the mountains were found three essentially arctic species that were not met with below the region of snow. These were the tit-lark, the gray-crowned finch (*Leucosticta griseinucha*) and the white-tailed ptarmigan (*Lagopus leucurus*). The tit-lark was abundant, rearing its young here, some of which were hardly able to fly as late as the last week of July. The gray-crowned finch and the ptarmigan were both common. The latter descends into the timber in winter, when great numbers are killed for food by the miners. The only ducks seen in the alpine region was a single pair of the common goosander. A single gadwall shot on the Platte in South Park was the only other species of the duck tribe met with on the present journey.

Near Colorado City two or three species of birds not yet mentioned were obtained or observed. One of these was the little known Rocky Mountain swift (*Panyptela melanoleuca*) which was quite numerous about the high cliffs in the " Garden of the Gods", and of which with great difficulty we procured four specimens. It was nesting in inaccessible crevices and weatherworn holes in the rocks, about midway up the high vertical cliffs, some of which are not less than three hundred feet high. They seemed very wary for so small birds, and flew with great velocity, rarely descending within reach of our guns. The ground tit (*Chamea fasciata*) was met with a few times, and on one of our excursions we saw a party of a dozen or fifteen woodpeckers of a species as yet apparently undescribed, and of which, unfortunately, no specimen was obtained. They were very wary, and led us a long chase over very broken country, at no time permitting us to approach within range of them. One was badly wounded, but finally succeeded in escaping. It was a species of the size and habits of Lewis's woodpecker, rising, like that species, almost vertically into the air in pursuit of insects, but was quite differently colored from any described American woodpecker. The tail appeared to be wholly white, except the middle pair of feathers, and there was also considerable white on the wings and about the head, the rest of the plumage being black. As we had too favorable a view of it to be mistaken as to its general characters, I mention it mainly for the purpose of calling the attention of other visitors to it, who may hereafter have the opportunity of visiting the mountains north-west of Colorado City.

It is not of course supposable that in our hasty reconnoissance of

five weeks of so extended a region that we saw all the species to be found there at the time of our visit, though we can hardly have failed to notice many that were common. The water birds we had few opportunities to observe. Among the *Grallæ* the greater and lesser tattlers (*Gambetta melanoleuca* and *G. flavipes*) the solitary and red-backed sandpipers (*Rhyacophilus solitarius* and *Pelidna Americana*) and the field plover (*Actiturus Bartramius*) were the only species seen besides the spotted sandpiper and plovers already mentioned; and these were only met with at Lake Pass, the second week in August. The only heron observed was one seen at a distance near Denver; and swimming birds were almost equally few. The absence of all flycatchers of the genera *Tyrannus* and *Myiarchus* in the mountains, and the scarcity of the *Sylvicolidæ* were noticeable features. The absence of the former at localities above seven thousand feet is not surprising, since they are emphatically southern forms; but we confidently expected to meet with a greater variety of warblers.

In conclusion, a few remarks on the ornithological faunæ of the region under consideration. Although the elevation of the Plains at the eastern base of the Rocky Mountains, in Colorado, is generally not far from six thousand feet, reaching seven thousand feet only on the divide between the waters of the Platte and the Arkansas at "Lake Pass," we have both at Denver and Colorado City a comparatively southern fauna, analogous in all essential features to the Carolinian fauna of the Eastern Province. From the base of the mountains up to about seven thousand five hundred feet we find a fauna more nearly analogous to the Alleghanian or to that of Southern New England. Thence upward to about ten thousand five hundred feet we have a zone more resembling the Canadian fauna of the East, or that of northern New England. From this point upward to the timber line the fauna is more analogous to that of the Hudsonian, or that of the shores of Hudson's Bay and the valley of the McKenzie River. Above this we have a region dotted with snow fields, where are found several essentially arctic forms.

REVIEWS AND BOOK NOTICES.

VIEWS OF THE MICROSCOPIC WORLD.* — An American handbook of microscopy is too much wanted to be received in any other than a kindly spirit. Prof. Brocklesby's "Views of the Microscopic World," Dr. King's "Microscopist's Companion" and Dr. Wythe's "Microscopist," have been unavailable for years; and Dr. Richardson's recent work is interesting exclusively to medical readers. Yet any one who takes up the new book with a determination to be unreservedly pleased with it, cannot but be disappointed to find it only a new edition of one of the old ones, which ignores its predecessor, and changes its name with the manifest intention of seeming like a new work.

"Views of the Microscopic World" written by the same accomplished author twenty years ago, was properly described, both by its name and in its preface, as no manual of microscopical vork, but as a common-place book of microscopic views, a collection of almost disconnected descriptions and illustrations, each valued for its own merits, of what were then unfamiliar microscopic objects. It was written in a thoughtful, philosophical and devout spirit. Fresh from the study of Ehrenberg and Mantell, and from the enthusiastic and successful use of a (then) remarkable microscope, the author briefly introduced and described the instrument, and then, evidently with a will, gave the longest chapter of the book, full of interesting descriptions of the diverse organisms classed by Ehrenberg under the vague name of Infusoria. Next came an t erest ing medley of information in regard to Fossil Infusoria. Larger aquatic animals followed, up to insects, in a short chapter. Then came two chapters, the most valuable because the most unique, with numerous lithographic illustrations of wood-sections, and of artificial crystallizations. A final chapter reviewed the parts of insects, and threw into the bargain mammals, birds, reptiles and fishes — to say nothing of mollusks and vegetables. The volume, now little known, was pleasant and conversational in its tone, the more so, perhaps, because informal, unclassified and beyond the reach of scientific criticism; and though published in an

* The Amateur Microscopist; or Views of the Microscopic World. A Handbook of Microscopic Manipulation and Microscopic Objects. By John Brocklesby, A.M. New York: Wm. Wood & Co. 1871.

unattractive style, would have been more successful had it not appeared in advance of the present demand for works upon the subject of which it treats.

The present edition is the old one, only moderately modernized by some minor alterations. The name is changed, for the worse as to the contents of the volume, but for the better as to the fashion of the day; the impracticable microscope of the original frontispiece properly gives way to a cheap but useful instrument of modern style; a rewritten preface and introduction form connecting links between the name and the book; and the Infusoria, though not rewritten, are somewhat rearranged by the separation of the vegetable forms. The rest of the work is simply reprinted, with scarcely more than a few verbal corrections. The woodcuts and lithographs are scarcely equal in quality to the original, and a considerable number are suppressed, including a part of the interesting series of wood-sections and crystallizations, the one section of a root being one of the loved and lost.

The treatment of Diatoms, and indeed "Infusoria" generally, of the influence of temperature on vitality, of deep-sea soundings and dredgings, and of the microscopic anatomy of the higher plants, gives no hint of the vast labor, and wonderful results of the last twenty years. The unfortunate haste with which this edition was prepared, is further shown by an abundance of minor errors, such as the failure to cut out all the allusions to the suppressed plates, and the reference of the second description of a fig. to the wrong cut (Fig. 2), which is given in the right place, instead of to the right cut (Fig. 3), which is given several pages beyond. Of course minute and technical criticism would be impossible in regard to a book which scarcely claims to be scientific; but such errors as the above should have been corrected, and it would scarcely be too much to ask a slight improvement in classification. There is a certain interest and advantage in giving, side by side, the hairs of insects and of quadrupeds, and the scales of insects and of fishes, and the crystals from plants, and those artificially formed upon slides; but there can scarcely be any advantage in throwing the corpuscles of blood, the pollen of plants, and the anatomy of the flea, all into the same group.

Amateur microscopists will want to place this name-sake book by the side of the really more serviceable Lankester's Half Hours and Wood's Common Objects; but intelligent general readers, and

natural history students are those who will find it of the most real use. We are sincerely thankful to the publishers for the present attractive edition of this lately unattainable work; though we cannot approve of their economy in suppressing a part of the plates, and cannot but regret that they did not induce the author to give us a book written in the spirit of 1871, instead of republishing the ideas of 1850.—R. H. W.

REVISION OF SOME OF THE AMERICAN BUTTERFLIES.*—In advance of the publication of the volume on the Butterflies of New England, upon which Mr. Scudder has been for some time engaged, and which is not far from completion, the public is presented with this digest of the results reached by the author in a revised classification and nomenclature of the butterflies of the New England and Middle States.

The four years of almost continuous labor which the author has devoted to the preparation of the volume above referred to,—the abundant material which the kindness of friends has placed at his disposal, the favorable opportunity enjoyed by him during a two years' sojourn in Europe for the study of large numbers of European forms in connexion with our own, and a persistent determination to investigate personally, so far as possible, each of the four stages of every species reviewed by him,—lead us to indulge the hope that the scheme submitted in the above paper may be received by both American and European lepidopterists as more satisfactory than any which has preceded it. It is presented at the present time, to afford opportunity for examination and criticism, and for the correction in the forthcoming volume of any errors which may be discovered.

Although it has long been evident that many changes must necessarily be made in the classification and nomenclature of our diurnals, yet those introduced in this paper are so numerous, and some of so radical a nature, that the entomological public will be startled at their presentation, and prompted to look for some way of escape from their unpalatable acceptance.

Of the butterflies occurring in New England and adjoining States, probably exceeding one hundred and twenty-five species, only eleven of the number retain unaltered, in this revision, the names

* A Systematic Revision of some of the American Butterflies, with brief notes on those known to occur in Essex County, Mass. By Samuel H. Scudder. From the Report of the Peabody Academy of Science for 1871, pages 24 to 82 inclusive. Salem, Mass. 1872.

under which they are at present recorded in our lists. It will require some time to familiarize the tongue with the substitution of *Basilarchia Astyanax* for *Limenitis ursula*, *Doxocopa Herse* for *Apatura Clyton*, *Papilio Antiopa* for *Vanessa Antiopa*, *Incisalia Irus* for *Thecla Arsace*, *Strymon Titus* for *Thecla Mopsus*, and *Euphœdes Glaucus* for *Papilio Turnus*. It will tax the memory to charge it with the names of the forty-five genera in which our Hesperidæ are arranged; yet this, and whatever else is required, should be cheerfully accorded, when convinced that the arduous work of the author has been properly performed, for only through serious disturbance is error to be eliminated.

It will be observed that quite a large number of the generic groups of Hübner, with a few of Scopoli and Schrank, have been reclaimed from their desuetude. This, the author informs us, has been done, only after a critical study of the history of every genus proposed for butterflies down to the period of Hübner's catalogue in 1816, and in strict obedience to the laws of priority regulating zoölogical nomenclature. Of the many new genera introduced, the characters of two are presented in detail, drawn from the larval, pupal and imaginal states, to serve, it is stated, as an illustration of the manner in which all the genera will be treated in the volume in preparation: these two genera are Papilio of Linnæus (having *P. Antiopa* for its type), and Aglais of Dalman (with *P. urticæ* for its type); their details occupy ten pages.

The classification of Mr. Scudder, exclusive of the generic groups is as follows:

Families.	Sub-families.	Tribes.
NYMPHALES Linn.	OREADES Borkh. TRIBUNI Herbst. NAJADES Borkh. HYPATI Hübn.	*Archontes* Herbst. *Phalerati* Hübn. *Præfecti* Herbst. *Dryades* Borkh. *Hamadryades* Borkh.
RURALES Fabr.	VESTALES Herbst. EPHORI Herbst.	*Armati* Hübn. *Adolescentes* Hübn. *Villicantes* Hübn.
PAPILIONIDES Latr. restr.	DANAI Linn. restr. EQUITES Linn.	*Fugacia* Hübn. *Voracia* Hübn. *Frugalia* Hübn.
URBICOLÆ Fabr.		

The Family NYMPHALES embraces the Satyridæ of Swainson, Danaidæ of Doubleday, Nymphalidæ of Swainson and Lybytheidæ of Westwood. It is equivalent to the Nymphalidæ and Lemoniidæ

pars (subfamily Libythæinæ of Kirby's catalogue, 1871). It includes twenty-three genera, among which are several established by Hübner in 1816, but to which our species had not hitherto been referred, as Œneis, Enodia, Minois, Megisto, Doxocopa and Polygonia. Under Nymphalis is placed *Vanessa J-album*, as an intermediate form between those which we have recognized as Vanessa and Grapta. *Vanessa Antiopa* is made the type of the restricted Linnæan genus Papilio, while Vanessa is retained for *Atalanta*, *huntera* and *cardui*. Argynnis embraces *Cybele*, *Aphrodite* and *Atlantis*, — a new genus, Speyeria, being established for *Idalia*, with *Myrina* and *Bellona* assigned to Brenthis of Hübner. Our Melitæas are grouped in four genera as *Phyciodes Tharos* and *Phy. Batesii*, *Charidryas Nycteis*, *Limnœcia Harrisii*, *and Euphydryas Phaeton* — the last three generic groups being new. We miss the original genus Melitæa, the reason of which is not evident, but we presume that it has been retained for such European forms as *Maturna*, *Didyma*, *Parthenie*, *Artemis*, etc. Our Limenitides *Disippe*, *ursula* (= Proserpina Edw.) and *Arthemis* being distinct from the European forms are assigned to the new genus Basilarchia. Danais [Danius], Junonia, Euptoieta and Libythea remain as before.

The family RURALES is a subdivision of the Linnæan group PLEBEII consisting of the smaller butterflies, of which those marked with dark spots were denominated Rurales and those with pellucid spots Urbicolæ. It is equivalent to the Erycinidæ and Polyommatidæ of Swainson's system, to the Erycinidæ and Lycænidæ (Leach) of Westwood, Lemoniidæ pars and Lycænidæ of Kirby's catalogue. We note the following disposition of material in this family:

Our only northern representative of the subfamily VESTALES Herbst (Erycinidæ of Swainson — *Charis borealis* Gr.-Rob., is referred to the genus Polystichtis of Hübn. The Theclas constitute the tribe *Armati* of Hübner, with a division in six genera. *Melinus*, *smilacis* and *Læta* typify three new genera of a single species each, viz., Callipareus, Mitouri and Erora. With *Niphon* as the type, *Augustus* and *Irus* form the genus Incisalia Minot MS. In the original genus Thecla, are retained *Ontario*, *Liparops* (= strigosa), *Edwardsii*, *Calanus* (= inorata), and *Acadica; Mopsus* appears as *Strymon Titus* (Fabr.).

Of the Lycænidæ, our four species of the *Argiolus* type are

referred to Cyaniris of Dalman; *Scudderii* and *Comyntas* respectively to the Hübnerian genera of Lycæides and Everes; for *Pembina* the new genus of Glaucopsyche is established having *Lygdamus* for its type. The genus Lycæna, after various limitations and some misapplications, and the last restriction in 1832 by Swainson to species of the European *Phlœas* type, is retained for *Americana* and *Epixanthe*, leaving *Thoe* for the genus Chrysophanus under the specific name of *Hyllus* by which it was first described by Cramer.

The family of PAPILIONIDES comprises the DANAI and EQUITES of Linnæus, and the Pieridæ of later systematists. In it, fourteen genera are enumerated in the present paper.

The reference of *Eubule* to Catopsila of Hübner instead of Callidryas Boisd., is in accordance with Kirby's recent arrangement. Colias is retained for *Philodice*, *Eurytheme* and *Keewaydin; rapæ* and *oleracea* are removed to the genus Ganoris of Dalman; *protodice* and *vernalis* to Synchlœ of Hübner.

The dismemberment of Papilio reaches its greatest possible extent in the assignment of our five species to as many genera, established by Scopoli, Dalman and Hübner. Under their new nomenclature they present themselves as *Laertias Philenor*, *Pterourus Troilus*, *Euphœades Glaucus*, *Iphiclides Ajax* and *Amaryssus Polyxenes* (= Asterias).

So long ago as in 1859, it was announced that Mr. Scudder was engaged upon a monograph of our Hesperidæ. The result of his study in this direction is given in part, in the systematic arrangement now before us of the heterogeneous material which had been previously referred to the genera Eudamus, Nisoniades, Pamphila and Hesperia—the latter serving as a convenient receptacle for whatever species might not properly be located elsewhere. For the order evoked from so great confusion, we owe the author a debt of gratitude.

Under the Linnæan name of URBICOLÆ, our American Hesperidæ (including all the United States species together with a few from Central America) are presented in forty-five genera, of which number, thirty-two are new. The generic characters are omitted from the present paper, that it might not be unduly extended. As we turn the pages in hurried review, among much that draws attention, we note the following:

To *Thymele Proteus* Linn., of the occurrence of which in New

England we were not previously aware, a range is ascribed through Eastern North America as far north as Connecticut. *Epargyreus Tityrus* (Fabr.) and *Achalarus Lycidas* (Sm.-Abb.) are credited with an equally extensive distribution, viz., from Florida to New England. Indeed, the range of the members of this family is in such marked contrast with those of the other groups, that the occurrence in New York or New England of any of the Southern forms need not occasion surprise. *Oligoria maculata* (Edw.), which on page 61 of the paper under notice, is assigned to Florida, has on one occasion been captured in New York, latitude 42½°. As ranging from the Gulf to the Eastern States, the following Hesperians are recorded in these pages: *Bathyllus*, *Pylades*, *Brizo*, *Martialis*, *Horatius*, *Catullus*, *Numitor*, *vialis*, *Samoset*, *Logan*, *Zabulon*, *Phylœus*, *Sassacus*, *Huron*, *Brettus* (= Wingina), *Egeremet*, *Olynthus* and *Monoco*. Additional information of distribution would undoubtedly materially extend the above list.

The species of Nisoniades, with the exception of *Catullus*, which is made the type of a new genus, Pholisora, are referred to Erynnis of Schrank, in accordance with Staudinger's restriction from its original extension over all the European Hesperians. Hesperia is limited to the few species of the European *malvæ* type, our only northern representatives being *H. tessellata* nov. sp. (Penn. to Texas) and *H. centaureæ* Ramb. (= Wyandot Edw).

Some good service is rendered in the determination of synonymy, as may appear from the following citations: *Numitor* Fabr. = puer Hübn. and marginatus Harris; *Samoset* Scudd. = alternata Gr.-Rob.; *Iowa* Scudd. = vitellius Sm.-Abb.; *Logan* Edw. = Delaware Edw.; *Ætna* Boisd. = Egeremet Scudd.; *bimacula* Gr.-Rob. = Aconootus Scudd.; *Taumas* Fabr. = Ahaton Harr.; *Accius* Sm.-Abb. = Monoco Scudd. and punctella Gr.-Rob.

We welcome this revision as an exceedingly valuable contribution to American Lepidopterology, — the more welcome as foretelling the bounteous harvest to be enjoyed, when the fruits of years of culture and of toil over extended fields, shall be spread before us, in the volume of which this modest pamphlet is the precursor.

A few typographical errors occur in the paper.* It certainly

* Page 10, line 28, for POLYCHLORUS *read* POLYCHLOROS; p. 26, l. 2, for *Telenis* read *Selenis*; p. 31, l. 1, for **MITOURI** *read* **MITOURA**; p. 33, l. 32, for LYGDARNUS *read* LYGDAMUS; p. 35, l. 16, *omit* "has never been described; it;" p. 36, *transfer* Lycæna No. 2 *to* Chrysophanus on same page; p. 39, l. 6, for PALIDNE *read* PELIDNE; p. 39, l.

reflects great credit upon the gentlemen under whose supervision the paper was printed, that without the opportunity of revision by the author, and from manuscript closely written on both sides of thin paper, as we incidentally learn, so very few errors should have occurred.

BIRDS OF KANSAS.*—The present list, "though based upon the personal observations of the author during a residence of six years in Kansas," does not purport to be a complete catalogue of the birds of that State. It embraces the names of two hundred and thirty-nine species, and contains short notes respecting the relative abundance and special haunts of most of them. Whilst of considerable value as a faunal list, it abounds in errors to such an extent as greatly to impair its usefulness. Among the one hundred species marked with an asterisk to show that they are "known to breed in Kansas" we find *Regulus calendula*, *Dendrœca coronata*, *Pinicola* "*canadensis*," *Passerella iliaca*, and *Ægialitis semipalmatus*, whose southern limit in the breeding season is well known to be many hundred miles north of Kansas. On the other hand such characteristic and abundant summer species as *Calamospiza bicolor* and *Coturniculus passerinus*, and nearly twenty others now well known to breed in Kansas, are without the asterisk. Among the species one naturally expects to see in a list of the pretensions of the present, we look in vain for *Dendrœca cærulea*, *Vireo Noveboracensis*, *Plectrophanes ornatus*, *P. Maccownii*, *Guiraca melanocephala*, *Spizella pallida*, *Peucæa* "*Cassinii*," *Antrostomus Nuttalli*, *Pediœcetes phasianellus* and *Ægialitis montanus*, all of which are more or less common, whilst some of them are among the most characteristic species of the middle and western portions of the state. Among the western species mentioned are *Falco polyagrus*, *Colaptes* "*hybridus*," *Poospiza bilineata*, *Passerella schistacea*, *Junco Oregonus*, *Icterus Bullockii*, and *Centrocercus urophasianus*, all of which may occur of course as stragglers, though not often seen in the latitude of Kansas, east of the Rocky Mountains. Perhaps for *Centrocercus urophasianus* the writer meant to have written *Pediœcetes phasianellus*, and for *Ægi-*

15, for EURYTHAME *read* EURYTHEME; p. 45. line 31, for *Calverlyi* read *Calverleyi*; p. 49, l. 2, for *Epay. Pityrus* read *Epar. Tityrus*; p. 50, l. 25, for THRASS *read* THRASO; p. 50, l. 12, for *Endamus* read *Eudamus*; p. 59, l. 15, for *Palatka* read *Pilatka*; p. 62, l. 2, for EUDRYAS *read* EUDAMUS; p. 62, l. 9, for *Buleuta* read *Bulenta*.

* Catalogue of the Birds of Kansas. By Frank H. Snow. Professor of Natural History and Meteorology in the University of Kansas, Topeka, 1872. pp. 8.

alitis semipalmatus, *Æ. montanus*, both of which species, as already noticed, are omitted from the list, though it is hard to suppose that in either case he could have mistaken the one bird for the other.

While faunal lists of the birds of the western states and territories are so very desirable, they more than defeat their usefulness unless prepared with a considerable degree of accuracy. If the writer of the present list had restricted it to a smaller locality, say for instance a single county, and had added from his note books more explicit data, especially in respect to the times of arrival and departure of the birds, his catalogue would have had far more value as a faunal record, and would doubtless have been as a whole much more accurate.—J. A. A.

NEWTON'S ORNITHOLOGICAL REGISTER.*—The pamphlet before us is a description of a Record of Ornithological Observations made by Messrs. A. and E. Newton for the years 1850–'59. Great advantage flows from a continuous series of such observations in any department of Natural History, and the system devised and perfected for this purpose seems to us very praiseworthy. It is difficult to gain an idea of this unique register without inspection of an accompanying lithographic sheet representing a month's record in *fac-simile;* but it will suffice to say that the record is kept almost entirely by means of a few simple but expressive symbols, the use and purport of which may be readily learned. By these signs a day's observations may be duly recorded in a few moments, and the system recommends itself for this if for no other reason. Prof. Newton says that the benefits accruing were "out of all proportion" to the time and trouble bestowed; and not the least of these, was the enforcing of a habit of close daily observation, essential to the culture of practical ornithology. Many extremely valuable, and some novel, facts were ascertained respecting the movements, the pairing, nesting, singing of birds, and their general habits. It was unexpectedly discovered, among other things, that the meteorological observations made in the hope that one set of observations might throw light on the other, gave negative results, no birds proving reliable weather-prophets. We should judge that the digestion of the great mass of material accumulated in this

*On a Method of Registering Natural History Observations. By Alfred Newton. From the Norfolk and Norwich Society's Proceedings, 1870.

way would be a matter of much time and care, but the same is true of observations recorded in the usual manner.

We wish that a number of copies of this interesting brochure could be placed on sale at the Naturalists' Agency, so that our ornithologists might have the opportunity of acquainting themselves with the merits of the record, and consider the propriety of adopting the system. — E. C.

BOTANY.

THE GEOGRAPHICAL DISTRIBUTION OF COMPOSITÆ. — Mr. G. Bentham read a paper on this subject at two recent meetings of the Linnæan Society, in continuation of his paper on the structure of the same order of plants (*Academy*, vol. iii. p. 73). The genera and species of this largest order of flowering plants are about equally distributed between the Old and New World; of the genera about 410 are found in the former and 430 in the latter; of species, about 4400 in the Old World and a rather larger number in the New. Not quite 70 species are common to the two hemispheres, and these mostly belong to the extreme northern regions; a few are common to New Zealand and Antarctic America; not more than a dozen tropical species are found in both the Old and New World, and some of these are coast plants. The form which Mr. Bentham looks on as prototypic, and possibly ancestral to the whole order, includes a few closely allied genera, distinguished by their regular corolla, belonging rather more to the American than the Old World distribution, being found in Chili, with an outlying genus in St. Helena. Other types, apparently of great antiquity, are found in Africa, Australia, and Western America. Since the separation of the Indo-Malayan and Australian regions from one another, there appears to have been a continuity of races of Compositæ across the tropics from south to north. The paper, which enters exhaustively into the distribution of the various tribes and more important genera, will be published in the "Journal of the Linnæan Society." — *Academy.*

THE COLORING MATTER OF FUNGI. — Mr. W. C. Sorby has communicated to "Nature" a series of observations on the coloring matters of the fungi found in his own neighborhood (Sheffield in Yorkshire). So far he has been able to determine, by means of their optical and other properties, the existence of at least thirty distinct coloring matters, and he believes the number will be eventually larger. The majority of fungi contain at least two

and many contain several different colored substances which can be separated or perfectly well distinguished. Fully twenty have such well-marked optical characters that they could be recognized without difficulty in other plants; but of these only one is known to occur in any plant not a fungus. This is the fine orange color, soluble in bi-sulphide of carbon, found in *Calocera viscosa*, which agrees perfectly with the more orange-colored xanthophyll of some faded leaves, and of the exterior layer of the root of the carrot. Closely allied species sometimes contain two different kinds of coloring matter in common, but very often one or more differ; while at the same time species belonging to somewhat widely separated genera are occasionally colored by identical substances. Notwithstanding this, on the whole, there appears to be a very decided connection between the general organization of the plant and the particular kind of coloring-matter developed in it.— A. W. B.

New Stations of Rare Plants.—*Saxifraga aizoides.* Warsaw Glen, Wyoming Co., N. Y. Very abundant high up on shaded, wet rocks. (Genesee Shales.) Also on the west bank of the Genesee River at Portage, Wyoming Co., N. Y. between the middle and lower falls where it occurs, for nearly a mile, on the high cliffs. Found also on the Gardeau Bluffs (425 ft. high) still further down the river.

Lythrum Salicaria. Marshes at the head of Cayuga Lake.

Primula Mistassinica. South bank of Fall Creek, Ithaca, just below the Triphammer Fall, — abundant.

Pinguicula vulgaris. — With the preceding, and also in several places on Cascadilla Creek, Ithaca.

Sisymbrium canescens. Enfield Glen, Tompkins Co.; Watkins Glen, Schuyler Co., N. Y.

Phlox subulata. Everywhere about Ithaca. Also on the Gardeau Bluffs, Wyoming Co., N. Y.

Sedum ternatum. A few specimens in the glen of Six Mile Creek, Ithaca — obviously indigenous.—D. S. Jordan, *Instructor in Botany, Cornell University.*

ZOOLOGY.

A Rare Animal.—On Saturday, February 17, 1872, there was brought to me an animal I had never seen before, and which I thought was new to this region. In general appearance it very

much resembled a fox, except that it was smaller and more slender in its proportions, and it had a ringed tail as long as its body. The facial expression reminded me of a raccoon. Upon referring to the "Quadrupeds of America" I found it to be an animal of which it was the sole representative both in genus and species, for it proved to be the *Bassaris astuta*, the generic name being derived from a word signifying a little fox and the specific name having reference to its manners and habits. It is described as an inhabitant of Mexico and Western Texas, was originally found in the vicinity of the City of Mexico and referred to by the old Spaniard Hernandez. It was first brought to the attention of naturalists by Mr. Deppe who, in 1826, sent a specimen to Berlin from Western Texas. The *first* scientific description was by Lichenstein, who named it as above. It is carnivorous, subsisting on small animals, birds and insects. Red river, in Texas, is given as its *extreme* northern geographical limit, and it is an interesting fact in natural history to find such an extreme southern species existing in full size and vigor in this so much more northern latitude, so far from what has been considered its native habitat. It suggests some interesting questions. Is it an accidental wanderer from its far-off home? This can hardly be, for, although probably full grown, its teeth indicate it as a young animal; and the great distance to be travelled from Texas to Central Ohio, and the time necessarily consumed in the journey, as well as the obstacles of great rivers to be crossed, are against the theory of a single and chance migration from its original locality. Have we here, then, another example of the wonderful power of nature which enables the animal "in the struggle for life" to adapt itself to the varying conditions and circumstances with which it is surrounded? For our specimen is thickly clothed with fur, while its progenitors, like most other warm climate species, were probably thinly covered with hair, and this fact is against any *recent* migration, for surely more than one season would be required to convert a simply haired, into a fur-bearing animal. I conclude our specimen was native born in the locality where it was found, and if others of its species in Mexico and Texas are without fur, our animal is a descendant from those which, perhaps, through many generations, have been gradually fitted for a residence in a more northern climate.

The little animal of which I have been speaking measured thirty-

two inches from the end of its nose to the tip of the tail, and when living would stand, I think, about seven inches in height. Its body was sixteen and one-half and its tail fifteen and one-half inches in length, with sixteen rings alternately black and white. It was killed in Fairfield County, where I understand there were two of them, and as this one is a male, the other was most probably a female, and it is to be hoped may yet be captured.—J. SULLIVANT, *Columbus, Ohio.*

GEOGRAPHICAL DISTRIBUTION OF BASSARIS ASTUTA.— A late number of the "Ohio State Journal" contains an interesting account by Prof. J. Sullivant, of the capture of this animal in Fairfield County, Ohio, a locality considerably removed from the habitat of the species as hitherto known. This curious creature, the only American representative of the *Viverridæ* or numerous family of the civet cats, etc., of the old world (though not belonging strictly to that group of animals), has always been supposed to be a Mexican form, restricted in its northern range to Texas, Arkansas and corresponding latitudes, thence westward. (See Audubon and Bachman, Quad. of N. A. ii, p. 314, pl. xcviii; Baird, Mam. of N. A., p. 147; Coues, Am. Nat. i, p. 351.) As corroborating Professor Sullivant's article, which gives, besides, several interesting facts and suggestions, we may state that Mr. J. A. Allen, of Cambridge, during his recent explorations in the West, obtained unquestionable evidence of the occurrence of *Bassaris* in the vicinity of Fort Hays, Kansas.—ELLIOTT COUES.

COLORADO POTATO BEETLE.—I notice that, in the April No. of the AMERICAN NATURALIST, my friend Sanborn Tenney is puzzled to account for the sudden disappearance of the Colorado Potato Beetle at Niles, Mich. The following extract from my fourth Report may give him some light on the subject. They have not disappeared for good, however, but will doubtless present themselves the coming season, though, mayhap, in greatly reduced numbers.

But if the bugs themselves were unprecedentedly numerous, so also were their natural enemies. I passed through potato patches where almost every *Doryphora* larva had upon the back of the neck, just behind the head one or more eggs of its deadly parasite *Lydella doryphoræ* Riley (Rep. I, Fig. 48), which is the only genuine parasite yet known to attack it; and what with the work of such natural enemies and the efforts of man, the pest suddenly

became about as scarce as it had been numerous before. All accounts agree as to the sudden diminution of its numbers in the month of June, and so far as Missouri is concerned, it did not increase to any alarming extent during the rest of the year. The disappearance was, in many sections, so thorough that it is very questionable whether man and natural enemies should alone be credited with the cause. The spring was uncommonly dry and warm, and, so far, was favorable to the increase of the insect; but the summer drought and extreme heat which followed were quite unfavorable to its multiplication. Warm dry weather in spring is congenial to the growth and well-being of the larvæ as they swarm upon and devour our vines; but at a later stage of their lives when they have to enter the earth to undergo their transformations, a great many of them will undoubtedly die if the earth continues excessively dry and hot. They will, in short, be dried and baked to death. Those who have had large experience in breeding insects, and who understand the importance of coolness, and especially of moisture in the successful development of those which transform underground, feel perfectly warranted in such an inference, even though no systematic and accurate experiments have been made to test its validity. The extreme heat and dryness of the season, furnished a good opportunity to employ the sun-scalding remedy, and it was fully shown that in an intense summer sun, the larvæ and even the beetles will very generally die if knocked from the vines on to the dry and heated ground, especially if the vines have been well hilled; and it is doubtless because the insect cannot thrive when the thermometer ranges near 100° F. that the southern columns of the spreading army extend far more slowly than the northern. Moreover, the past summer was not the first one in which the sudden disappearance of this insect under conditions of heat and drought has been noticed; for a similar state of things occurred in 1868, and Dr. Henry Shimer, of Mt. Carroll, Ill., then attributed such disappearance to the dryness of the season.* We are justifiable, therefore, in concluding that while dryness and warmth may be very pleasant and agreeable to the Colorado Potato Beetle in the spring or in the fall, they are nevertheless very destructive to it when intensified in the summer months.— C. V. Riley, *St. Louis.*

Singing Maryland Marmot.— For the last forty years the fact of the common Maryland Marmot, or Woodchuck, being able to sing like a canary bird, but in a softer, sweeter note, has been quite familiar to myself, and others who could be brought forward as witnesses. Mr. Lockwood seems to have an ear to hear, which calls out for the thousandth time our statement. Mr. Audubon Jr. is the only zoological naturalist who would lend a respectful

* Am. Nat. vol. iii, pp. 91-99.

attention, to what profit we know not. For my part I am prepared to believe in any amount of *animal* capacity; not a tithe of what is already known can be safely communicated to this generation which we hope to show ere long. Neither "the whistling of the Woodchuck in its burrow," by which we understand is meant the surprise or alarm chuckle, nor the loud challenge or pseudo-bark of the Marmot of the Sierra Nevada Mts. etc., are at all alluded to in the following remarks.

When a lad we caught a very young Marmot. Mother prudently forecasting care, etc., stoutly refused to allow the pet. Knowing the warm side of a mother's heart, we wisely resolved to try a little *finesse* in order to gain parental permission, so my older brother and myself took a saucer of milk, for we were sure, if she saw it take hold with both infant paws like a little babe as we had, the victory was ours. Brother got all things ready, and I insisted she should *just see it eat.* Her kind heart yielded. "Wouldn't have it die for the world; it took hold of the edge with both hands so like a little child." It was raised. It had a seat in the little high chair at the children's table full oft. Its earnest and restless concupiscent purr as it scented sweet cake and fragrant viands was wonderful. At length it became as familiar as the family cat and finally burrowed under the doorstep. My impression is now, and has always been, that it was a female. I used to watch the pet very closely to see how it sang, as children are apt to do. There was a slight moving of the nostrils and lips and consequently whiskers with an air of unmistakable happy or serene enjoyment. I question much if this is altogether unknown to others, *always excepting naturalists.*—A. KELLOGG, M.D., *San Francisco.*

THE POSITION OF THE CENTRE OF GRAVITY IN INSECTS.—M. Felix Plateau has contributed an important memoir on this subject to the "Bibliothèque Universelle Archives des Sciences Physiques et Naturelles," of which the following is an abstract of the most important conclusions arrived at. (1.) The centre of gravity in an insect is situated in the vertical and medial plane which passes along the longitudinal axis of the body. (2.) It occupies a position almost identical in insects of the same species, the same sex, and in the same attitude. (3.) The exterior form of the body rarely permits the determination of the exact position of the centre of gravity without experiment. (4.) It does not occupy

the same position in the two sexes of one species. It is sometimes less and sometimes more to the rear in the females than in the males and its situation depends on the relations existing between the different dimensions of the individuals. (5.) While standing, the centre of gravity is placed at the centre of the abdomen, or in the posterior portion of the thorax, and usually in the centre of the length of the body. (6.) When an insect is walking its centre of gravity undergoes constant displacement about a mean point, but the distances of displacement are too small to be measured. (7.) The displacement of the centre of gravity when an insect passes from a state of repose to that of flight, cannot be ascertained except with those species where the wings lie folded on the back when in a state of repose. The displacement is horizontal, and from back to front. (8.) During active flight, the centre of gravity oscillates continually about a mean position which corresponds with the instants when the extremities of the wings pass the point of crossing of the S-shaped curve which they describe in the air. (9.) In aquatic insects it is nearer to the lower than to the upper surface of the body. (10.) During swimming, the movements of the posterior feet, acting like oars, determine the oscillation of the centre of gravity around a mean position, which answers to the position of the swimming feet placed at the middle of their course.— A. W. B.

Occurrence of the Scissor-tail Flycatcher in New Jersey. On the 15th of April last, a magnificent specimen of the "Scissor-tail" (*Milvulus forficatus* Swainson), was shot on the Crosswicks Meadows, five miles south of Trenton, N. J. The specimen was a male bird, in full health and feather; weighing two and one-half ounces avoirdupois, and measuring thirteen and one-half inches from the tip of the beak to the extremity of the tail. The bird, when captured, was busily engaged in picking semi-dormant insects from the bark of the trees; creeping about very much as is the custom of the *Certhia Americana;* and all the while, opening and shutting the long scissor-like tail. The stomach, on examination, proved to be full of *small* coleoptera, insects, eggs and flies. The specimen has been mounted, and will be forwarded to you in a few days.

On reference to the Pacific R. R. Rep. vol. ix, page 168, we find that Prof. Baird states that the allied species, *Milvulus tyrannus*

Bon. is entitled to a place in the United States Fauna, "on account of two specimens in New Jersey, captured, at long intervals; and one or two seen by Mr. Audubon in the South-west;" but no mention is made of this species we have taken here in New Jersey, being found farther north than Texas, where it is quite abundant. We have already called attention to the fact of New Jersey being "a sort of neutral ground in the matter of geographical distribution;" and the occurrence of this southern flycatcher is an additional proof of the fact; the more so, because it was taken when the weather was chilly, and during a spring more backward than any for the past twelve years. It might perhaps have been easier to account for the presence of this bird had the season been far advanced, or had a southerly wind or storm prevailed for a week or ten days previously; but the very opposite of all this had been in reality the case. — CHARLES C. ABBOTT.

HABITS OF THE YOUNG CUCKOO.— Mr. Hugh Blackborn, of Glasgow, Scotland, has published an account of a remarkable contest witnessed between the young of the cuckoo and of the common meadow pipit or titlark. The nests contained two pipits' eggs and one cuckoo's, the former of which were hatched first. Within forty-eight hours after the hatching of the cuckoo, it had expelled both the pipits from the nests and on their being replaced struggled about till it got its back under one of them, when it climbed backwards directly up the open side of the nest, and pitched the pipit from its back on to the edge, finally forcing it off. After this had been done several times, the pipits were at length found dead and cold, and when they were then replaced the cuckoo made no effort to eject them. The singular part of the affair is that the cuckoo was perfectly naked and blind, while the pipits had well-developed quills on the wings and back, and had bright eyes partially open; yet they seemed quite helpless under the manipulations of the cuckoo, which looked a much less developed creature. Each time, the cuckoo, though perfectly blind, made with unerring certainty for the open side of the nest, the only part where it could throw its burden down the bank on which the nest was placed.— A. W. B.

GREAT AUK (*Alca impennis*).— Professor James Orton in his article on the Great Auk, AMERICAN NATURALIST, Dec., 1869, page 540, says:—"Once very abundant on both shores of the North

Atlantic, it is now believed to be entirely extinct, none having been seen or heard of alive since 1844, when two were taken near Iceland."

While at Montreal in Aug., 1871, Mr. Alfred Lechevallier, a naturalist who has collected largely in Labrador, informed me of a specimen in his possession of this supposed to be extinct species. It was found dead in the vicinity of St. Augustin, Labrador coast, in November, 1870, by some Indians from whom Mr. Lechevallier obtained it while collecting there at the time. It was a male, and although in a very bad state he preserved it and has recently sold it to a naturalist in France, who is to send it to Austria.

Although it was a very poor specimen he realized two hundred dollars.—RUTHVEN DEANE, *Cambridge, Mass.*

ACTIVITY OF TROUT AND SALMON.—Frank Buckland says of the American brook trout: "These American fish are much more active and, I was going to write—it may be even so—intelligent fish than the salmon or trout (English). Possibly they may have imbibed some of the national American sharpness. I think I shall consult them on the Alabama question."

I myself, while manipulating trout and salmon, at Orland, last November, learned that the former, although not a quarter the size of the salmon, was the more difficult fish to handle. This was partially owing to the plump shape of the trout, which caused the hand to slip off over the head or tail, and to a greater extent to its superior activity. The facility with which salmon yielded to manipulation was an agreeable surprise.—C. G. A.

THE CAROLINA HEMIRHAMPHUS.—My observations confirm and extend Dr. Coues' note (Am. Naturalist, vi., p. 49,) on this species. According to my note-book the fish was first seen by me Sept. 21, 1871, when several specimens were taken in a seine with mullet, and became very abundant about the last of the month. At this season vast schools of the Bluefish (*Pomatomus saltator*) were observed feeding upon the still vaster schools of the *Hemirhamphus*, which appear to be their favorite food. I have seen a Bluefish, when drawn into a boat, eject from its mouth as many as eight good-sized Hemirhamphi.—H. C. YARROW, M.D., U.S.A., *Fort Macon, N. C.*

POUCHED RAT (*Perognatus fasceatus*).—This is not very abundant in Texas. They dwell in burrows eight to ten inches deep,

with subterranean galleries, having several outlets. It has a large head, full lustrous black eyes, teeth exceedingly sharp and well set. Ears round and one-fourth of an inch long, tail two inches long, clavate and tufted with short, stiff hair; feet long, five fingers, body well formed with muscular arms and thighs.—G. LINCECUM, *Long Point, Texas.—Communicated by the Smithsonian Institution.*

A NEW BIRD TO THE UNITED STATES. An esteemed correspondent, Lieutenant Charles Bendire, U. S. Army, stationed at Tucson, Arizona, writes to me concerning an owl of the genus *Glaucidium* which he procured in that locality. It differs, he says, from Cassin's description of *G. gnoma* as follows:—"The tail-feathers, which are brown, are distinctly barred with fulvous, or rather rufous, fading into white at the edges of the inner webs. The feathers of the head are ashy-brown with very narrow longitudinal stripes of white. The quills of the wing are brown, their outer webs with small triangular spots of pale rufous, the inner webs with larger spots of the same shape, ashy white fading to pure white on the edges." He was thoughtful enough to enclose some of the characteristic feathers, and on my showing them to Mr. Ridgway, now our highest authority on American birds of prey, he pronounced them to be those of *Glaucidium ferrugineum*, a form not hitherto found within our limits.—ELLIOTT COUES.

THE NEST, EGGS, AND BREEDING HABITS OF HARPORHYNCHUS CRISSALIS. In a later communication, containing much novel and interesting information upon the birds of southern Arizona, Lieutenant Bendire furnishes a most excellent biography of this species, which I lose no time in making public, since nothing of special consequence has hitherto been recorded. Although the bird is still extremely rare in collections, Lieutenant Bendire took no less than six nests with eggs during the fourth week of March last.

"The nest," he writes, "is externally composed of dry sticks, some of which are fully a quarter of an inch thick; the lining consists exclusively of dry rotten fibres of a species of wild hemp, or Asclepias; in none of the nests did I find any roots, leaves or hair. The inner diameter of the nest is about three inches, with a depth of about two inches. Taking it all together, it is not very artistically constructed. None of the nests were more than three feet from the ground. In two cases I found nests in a dense bushy thicket of wild currant, twice again in willow bushes, and

in another instance in an ironwood bush. The red-vented thrush is very shy, hard to observe, restless and quick in its movements. It appears to prefer damp, shady localities near water courses, and confines itself principally to spots where the wild currant is abundant. At present [Mar. 27], it appears to feed principally on insects. Its flight is short — only long enough to enable the bird to reach the next clump of bushes. It seems to have more frequent recourse to running than to flying, and dives through the densest undergrowth with great facility and swiftness. The usual number of eggs laid by this bird (strange as it may appear) is only *two*, of an emerald green color, and unspotted. The first set I found [Mar. 22] contained small embryos, the third [next day] was only a single egg with a very large embryo; it was broken, and must have been laid as early as the tenth of March. From the number of nests taken it would appear that this bird is common; but this is by no means the case, and I believe I have found every nest of it on the Rillito. I never saw the bird along the Santa Cruz River, near Tucson, or in any other part of the Territory where I have been, including a good portion of the Salt River and Gila country." Lieutenant Bendire is evidently observing and collecting with zeal, industry and discretion, in an interesting and little-worked field. Important results are to be anticipated from his labors, and I am sure that other ornithologists join me in wishing him abundant success. — ELLIOTT COUES.

INTELLIGENCE IN MONKEYS. I have two species of *Cebus* in my study, *C. capucinus* and a half grown *C. apella*. They are "Jack" and "Jim," and a friend inquires whether they are not like the James and John of scripture, *sons of Cebidæ* (ee)? Jack displays a thousand traits of monkey ingenuity. He is an admirable catcher, seldom missing anything from a large brush to a grain, using two hands or one. His cage door is fastened by two hooks, and these are kept in their places by nails driven in behind them. He generally finds means sooner or later of drawing out the nails, unhooking the hooks, and getting free. He then occupies himself in breaking up various objects and examining their interior appearances, no doubt in search of food. To prevent his escape I fastened him by a leather strap to the slats of the cage, but he soon untied the knot, and then relieved himself of the strap by cutting and drawing out the threads which held the flaps for

the buckle. He then used the strap in a novel way. He was accustomed to catch his food (bread, potatoes, fruit, etc.) with his hands, when thrown to him. Sometimes the pieces fell short three or four feet. One day he seized his strap and began to throw it at the food, retaining his hold of one end. He took pretty correct aim, and finally drew the pieces to within reach of his hand. This performance he constantly repeats, hooking and pulling the articles to him in turns and loops of the strap. Sometimes he loses his hold of the strap. If the poker is handed to him he uses that with some skill in the recovery of the strap. When this is drawn in, he secures his food as before.

Here is an act of intelligence which must have been *originated* by some monkey, since no lower or ancestral type of animal possesses the *hands* necessary for its accomplishment. Whether originated by Jack, or by some ancestor of the forest who used vines for the same purpose, cannot be readily ascertained.—Edw. D. Cope.

GEOLOGY.

A Glacial Phenomenon. — On Sunday afternoon the writer of this visited the shore of Lake Winnebago,* at the foot of Washington street, and found the ice in the lake apparently solid, with the exception of a narrow strip about twenty feet wide, extending along the shore as far as could be seen. In this belt the ice had thawed out, leaving an open space of water. During Sunday night, as will be remembered, a severe snow-storm came up, accompanied by a fierce east wind, blowing almost a hurricane. On Monday morning the ice in immense cubes was piled to the height of from twenty to twenty-five feet along the shore forming a huge breastwork two or three rods in width. So powerful was the force with which the ice moved that large boulders two or three feet in diameter were lifted high in the air. Trees growing on the beach were broken square off, and in one or two cases torn out bodily by the roots and carried several rods. About half way between Washington and Merritt streets, a large basswood tree about two feet in diameter formerly grew on the beach but a few feet from the water. Now its trunk and roots lie at a distance of thirty or forty feet, carried there by the irresistible

* Lake Winnebago is in Wisconsin. It is twenty-eight miles long and ten wide, covering an area of two hundred and twelve square miles. Similar phenomena occur on other small lakes throughout the north-west.

force of the glacial upheaval. At the residence of R. J. Harney on the bank of the lake, the ice broke down and destroyed a large number of valuable fruit trees and serious fears were at one time entertained that the house would be carried away.

Hundreds of spectators have visited the shore to look at the immense pile of ice which is now melting in the sun's rays.— I. A. Lapham, *Milwaukee.* — *From the Oshkosh Northwestern.*

ANTHROPOLOGY.

Fossil Man in France. — We have a great find here — Mr. Revière of Paris has been carrying on excavations in a bone cave here for all the past winter, digging it completely out. He has at last obtained a nearly complete skeleton, skull perfect, of a large sized fully grown man, at a depth of about ten feet in the accumulated debris of the cave, and the bottom is not yet reached. Its position tells of probable burial, but at that depth it means something. The skull is well formed, judging from photographs before me. — S. H. Scudder, *Mentone, France.*

MICROSCOPY.

Deep-sea Life. — One of the latest contributions to our knowledge of this comparatively new branch of science, comes in the form of a Report on the Cruise of the School-ship "Mercury," in the Tropical Atlantic Ocean. The commissioners of public charities and corrections of New York, desiring that the practice voyages of the above named ship, which is used as a reformatory and nautical school for a part of the vagrant boys under their care, should be made also useful to science, furnished instructions and apparatus for taking a series of observations, including deep-sea soundings, between the coasts of Africa and of South America, during the early months of 1871. The microscopical interest of the voyage belongs to the fifty samples of sea water, partly from the surface, and partly from a variety of depths, brought up by means of a water collecting cylinder attached to a sounding line, and to the specimens obtained on fourteen occasions from the bottom, by means of Lieutenant J. M. Brooke's detaching apparatus. Professor Henry Draper's excellent and suggestive report, though devoted mainly to depths, currents, temperatures, etc., presents the following in regard to organisms: "It needed no special

proof that organic matter was present in every one of these samples, for the clearest of them contained shreddy and flocculent material, some of them quantities of seaweed in various stages of decomposition. With these vegetable substances were the remains of minute marine animals. As bearing upon this subject, I found, on incinerating the solid residue of a sample of water taken from two hundred fathoms, that the organic and volatile material was not less than eleven per cent. of the whole. Though the quantity of organic substance diminished as the stratum under examination was deeper, there still remained a visible amount in the water of four hundred or five hundred fathoms. It is probable, therefore, that even at the bottom of the ocean such organic substance may exist, not only in solution affording nutriment to animals inhabiting those dark abysses, as Professor Wyville Thompson has suggested, but also in the solid state. Plants, of course, cannot grow there, on account of the absence of light." The spectroscope revealed no hitherto-unknown element in these waters. Dr. Carpenter, to whom were transmitted the specimens of the bottom obtained from the quills of the sounding apparatus, writes: "As far as I can see, they consist of the ordinary Atlantic mud, chalk in process of formation, with the ordinary types of deep-sea foraminifera." The cruise of the Mercury furnishes, in several important particulars, confirmation of theories drawn more or less conclusively from the investigations of the preceding years.

INFUSORIAL LIFE.—Dr. J. Dongall, of Glasgow, in his recent experiments on this subject, has reached some rather novel and probably useful conclusions. Of the various substances used to prevent the development of animalcules, etc., in vegetable and animal infusions, he found the metallic salts to be by far the most powerful, sulphate of copper standing at the head of the list. The organic acids were decidedly less efficient; and carbolic acid occupied the fifth place, not the first. Last followed the alkaline earths, which were all very low except bichromate of potash. It would seem to be the tendency of these facts to show that for many purposes of disinfection, sulphate of copper would be most eligible; and that chromic acid and bichromate of potash are better than the fashionable carbolic acid.

THE NATURE OF MIASM.—M. Bolestra has reported his researches upon this subject, to the French Academy of Sciences.

The water of the Pontine Marshes, and of similar malarious regions, he found to contain invariably, along with the common infusoria, a minute algoid vegetation with an abundance of transparent, greenish-yellow spores, $\frac{1}{1000}$ mm. in diameter. This vegetation develops slowly in pure water and at low temperatures, but rapidly in the heat of the sun and amid decomposing organic material. It floats upon the water, giving an iridescent film when young, and its spores are found in the air near the marshes, and even at Rome, being most abundant in warm weather and after a rain or during a fog, and least so in a cool, dry atmosphere. Dr. Bolestra regards these spores as the miasmatic agent in the production of the intermittent fevers for which the localities are badly celebrated. That "miasm," the hitherto unknown cause of intermittent and remittent fevers, is a form of cryptogamic vegetation, was urged about six years ago by Professor J. H. Salisbury, M.D., of Cleveland, Ohio. He published in the "American Journal of the Medical Sciences, in January, 1866, an elaborate paper, proposing and sustaining this theory, and describing a number of vegetable organisms not very unlike those of M. Bolestra's paper.

"Eels" in Paste. — Many young microscopists have been puzzled to obtain these curious and amusing creatures which the books represent to be of universal presence in sour paste. F. K. explains in "Science Gossip," that the paste must be made of pure flour and water, boiled, and quite thick. It must be stirred every day with a wooden spoon, and the "eels" will appear in a few days in warm weather, but after a longer time in cold. The supply may be kept for years by adding a little fresh paste occasionally.

The Origin of "Guano." — The accepted theory of the nature of this familiar fertilizer was combated by Professor A. M. Edwards, at a meeting of the New York Lyceum of Natural History. He considers it a sediment, consisting of both vegetable and animal organisms, which formed at the bottom of the sea and was subsequently elevated as well as chemically changed. The perfect preservation of the diatomaceous shells is adduced as evidence in favor of this theory.

Arborescent Silver. — The beautiful specimens known by this name may be easily produced by the following method which is gleaned from "Science Gossip." A drop of a very weak solution of nitrate of silver is placed on the centre of a slide, and a piece of

fine copper or brass wire, suitably bent, is placed with one end on the slide in the centre of the drop and the other end lying firmly on the table. Crystallization commences immediately, and when it is sufficiently advanced the wire is removed, the remaining liquid poured off, and the crystals washed with a drop of distilled water (containing a trace of gum to fix the crystals on the glass) and mounted dry in a cell. The time required to obtain the best results will be learned by a few trials, and a variety of specimens may be obtained by varying the strength of the solution or the size of the wire.

ARTIFICIAL FOSSILS. — Metallic casts, preserving perfectly the microscopic structure of the wood, may be formed by the deflagration of nitrate of silver on charcoal. The process, as described by Dr. Chandler, consists in directing a blow-pipe flame upon a piece of charcoal upon which a crystal of the nitrate is lying. When deflagration commences, crystals may be successively added, and the silver, as reduced, replaces the particles of charcoal until a perfect copy, in metallic silver, is produced.

NOMENCLATURE OF OBJECTIVES. — The following remarks are suggested by the points discussed in Dr. Ward's paper on this subject in the March number of the NATURALIST. Dr. Ward well says of the prevailing practice. "To call two lenses of identical magnifying power respectively one-fourth and one-sixth inch lenses, is just as indefensible as to call two houses of equal height, forty and fifty feet high respectively." An apt illustration of this is afforded by Dr. J. J. Woodward's paper in the April number, where he cites an instrument invoiced $\frac{1}{30}$, which by actual measurement at the 'open point' was only a $\frac{1}{18}$? But other objectives by the same maker called $\frac{4}{10}$, are known to be nearly as short focus as $\frac{1}{4}$ or less than $\frac{1}{3}$, showing that no system is used in the nomenclature. Other instruments from other makers have given similar results. With such discrepancies, and confusion, microscopists have nothing to depend on in ordering or comparing their instruments.

The points from which the measurements are to be made is the question which is most obscure. Undoubtedly the best, and the true theoretic plan is to measure from the optical centre of the objective to the optical centre of the ocular, or the conjugate focus. This is the method of one maker of objectives. Practi-

cally it is next to impossible to apply the rule with mathematical exactness. Mr. Cross says, "because the compound objective has no optical centre;" but this is an error; several lenses combined must have an optical centre as truly as a single lens; but the difficulty is to find its place among the lenses first, and then to find where that place is on the outside of the tube. But for high power objectives it is so near the point between the front and middle combinations, that if that point is taken, there can be hardly an appreciable difference from the truth in the result. The optical centre of the ocular is the diaphragm, if that is in the place where it should be.

But in the modern objective the optical centre is a movable point by the collar for cover adjustment. The nearer the lenses are brought together the more the combination magnifies. Shall the objective be named at least power, or some other. I say the least, because it is a fixed point, always to be found; because it represents the least the instrument can do, and the owner knows that the power increases from that point; and because it seems to have been adopted in theory by most of the best makers, as but few of their *medium* powers have ever been found "over named." If they did not proceed on that principle, their objectives were still farther from what they were named than they have been found to be by that rule. It would certainly be desirable that makers should give the minimum as well as the maximum of focus for each objective. The practice of most makers seems to have been to make certain lenses by rule of thumb, *to be* called *e. g.* a fourth, put them together, give them the name, and sell them without any test of what their real focus should prove to be.

Angular aperture varies also with the change of cover adjustment, and the practice is to give that at its maximum only; Tolles, now, however, gives and marks sometimes both maximum and minimum. Dr. Ward suggests that it should be given at the same point as the name. It is usually at the minimum there; but it may be anywhere else; Tolles can make it the maximum at open point.

The question has been raised in regard to objectives with two front lenses, interchangeable, of different powers, as to what they should be called. Obviously they are practically two instruments, and should have the names proper to each front. This may be illustrated thus: Tolles will make an objective dry $\frac{1}{10}$, and to

that put another front $\frac{1}{20}$ immersion, would it not be preposterous to call the performance of the immersion front that of a $\frac{1}{10}$? His practice is to give two names; and as the originator of the plan of two fronts, he may have the right to fix the rule of nomenclature. — C. S.

Corrections to Prof. Tuttle's Paper in May Naturalist. In all the figures save the first, the secondary flagellum is represented as arising a short distance from the base of the first, instead of from the same point with it, which is what I *meant* to indicate in the drawings. The name of the genus which should have been *Uvella* is given as "Urella." The specific name near the bottom of page 286 should be *glaucoma*. — A. H. T.

NOTES.

American Association for the Advancement of Science: — We understand that the Committee having the next meeting in charge are unable to make any announcement of arrangements until they hear from the Local Committee in San Francisco.

Natural History Education at Harvard University: — The changes which have been made in the departments of Natural History at Cambridge within the last two years have been very great, greater perhaps than in any other school within the same time. As there are many persons of both sexes who are seeking opportunities for study such as the University now offers, we give a sketch of the plans of education in the different schools as far as they concern the student of natural history. There are five schools in the University where natural history is taught; the College, the Museum of Comparative Zoology, the Botanic Garden, the Scientific School and the Bussey Institution. Let us trace in a general way the course of a student in these departments.

The student who enters the college to-day is no longer compelled to follow the one uniform road over which the boy of twenty years past had to go; after his first or freshman year he may begin to turn himself into the paths of natural science. At the commencement of his second year he may begin his studies by courses which lay the foundations of a knowledge of chemistry, taught in the Laboratory, of Physical Geography, Geology and Meteorology taught by text-books, lectures and excursions in the field. The time allowed for these studies during this year, is es-

timated at twelve hours per week. It is expected that the student will, in this year, lay the foundations for the work he may wish to do during the following years, by getting that general idea of the physics of the globe, which forms the necessary basis for the work of the naturalist in any department of labor.

With the junior year the studies of a strictly biological character begin. One course includes the elements of comparative zoology, with elementary teaching in microscopy, another the elements of botany, a third the elements of comparative anatomy. The principle on which the teaching of zoology is based is that the student should at the very beginning be put into the position of an investigator. With this object in view the student is at first required to do all his work upon natural objects. Beginning with the solid part of a *Fungia*, or some other object of equal simplicity, the student is then required to draw and describe the specimen, aided only by such questions and suggestions as may be necessary to get him over the worst obstacles; as soon as he has done the little he can do in the way of close observation, he is given a Manacena or Agaricea which he proceeds to compare with the Fungia, and so making at least diagrammatic drawings with a dozen other specimens of Polyps, Halcynoid and Actinoid. Thus the student gets some idea of the general relations which exist among the members of that group; when, say, in thirty hours of labor he has got through this work, a few lectures serve to supplement and connect the knowledge he has obtained from the personal study of the dry parts, illustrated by a sufficient series of alcoholic preparations, and helped out by such individual teaching as can be given without weakening the habit of self-reliance. In this way he goes through group after group, until, from a study of about one hundred species, he has gotten a general idea of the organic forms above the Protozoa. In this stage of the student's work, care is taken to avoid the use of diagrams, this avoidance being dictated by the conviction that the student remembers the diagram and not the object. During this year botany is also taught with the same object and by much the same method. In connection with the zoological instruction, the students are taught the elements of microscopy, the development of the subject being left to the next year.

The second year courses are advanced zoology, palæontology, historical geology, geography and advanced botany. The first two

have one common feature; three lectures or readings are given each week to the discussion of the history of zoology and palæontology, with special reference to modern opinions concerning the relations of animals. An effort is made to acquaint the students with the character of the greater works in the science, by giving them constant opportunities for consulting them in their studies and by showing them the methods of the masters in the several departments. Besides this each student is required to pursue some special line of work. In the choice of subject the largest liberty is allowed, but the student is, however, recommended during a half year to study advanced microscopy; in this work the aid of an instructor is given for four hours a week. In this four months he should acquire a sufficient knowledge of the practical management of the instrument in all ordinary investigations. The laboratory is well supplied with instruments of instruction in this branch of work.

Besides the course in the history of the science, the student who takes the elective in palæontology is required to traverse the ground covered in that part of "Dana's Manual" which is entitled historical geology, acquainting himself in a practical way with the most important characteristic fossils of the several periods.

The greatest value in this work is set upon the keeping of full and accurate note books in both the last described courses. The rank of the student turns upon the condition of his note books, as much as upon the quarterly examinations which he is required to pass.

Those students who desire to contend for honors at the graduation in zoology or in palæontology, are required to have taken besides their junior election in natural history, one election in physical science, and at least three natural history elections in the senior year, in all of which they must have attained excellence. They are, moreover, required to write an acceptable thesis which must contain an original discussion of some question in biological science. Hereafter the junior electives will consist of a course in anatomy and physiology, one in zoology and one in botany, and the students in this as well as in the last year will be allowed to substitute for the themes required in other branches, theses upon scientific subjects prepared under the direction of their instructor.

The natural history education of the scientific school has undergone a great change within a year; hitherto the students have

worked with the professors of the several departments, giving their whole time to any specialty which they might select. This plan admirably suited as it was to the needs of the trained student who had fitted himself in other schools for the work of a special department, was not adapted to the needs of those to whom this teaching was to fill the whole office of higher education. With the introduction of the doctor's degree into the plan of the school, it became necessary to make a change which has long been desirable by fixing a definite scheme of general scientific instruction in place of the imperfect system which had hitherto prevailed. A three years' course has been arranged which secures to the student a broad view over the whole field of science and the advantage which comes from a knowledge of the methods of research in use in its several branches. It gives to those persons who may not have the desire or the means to go through a regular college course, a systematic training which will occupy their full time for three years and give the best results of culture which can be attained in any scientific course. Students who can pass the required examinations are admitted to the degree of bachelor of science. Graduates of colleges where science is taught in an effective way should be able to enter this course in advanced standing. Students of the college, graduating with honors in the departments of natural history, should be able to obtain the degree in this course in a year of study. The student is trained in the important art of expressing himself clearly on the matters which he is studying, by requiring him to keep carefully planned note books, and he is urged to the preparation of theses which may embody the results of some research. Ample opportunities are given for the prosecution of studies in the field by excursions during term time and vacation led by the instructors in zoology, botany and geology.

After two years' further study, one of which must be spent in Cambridge, the student may apply for the degree of doctor of science, which is given after an examination conducted by a committee appointed by the Academic Council of the University.

The study done, the preparation for the degree must be in some special department when the student will generally become the private pupil of some one professor. The degree will be a certificate of capacity as an investigator or teacher in the science which the student has made his specialty.

The resources of the University for teaching science are, it is

believed, not only unrivalled in this country, but unsurpassed in Europe. The scientific departments have a list of twenty-four instructors, and the material resources which they afford have cost in the aggregate over a million and a half of dollars. There are six museums in the University: the Museum of Comparative Zoology, the Botanical Museum, the Museum of Comparative Anatomy, Museum of Morbid Anatomy, the Museum of Mineralogy and that of Ethnology. These collections are unsurpassed by those of any educational institution in this country, and taken together they furnish an efficient basis for the acquisition of the wide ranging knowledge on which a scientific career must be based. The opportunities for contact and intercourse in scientific societies are excellent. There is a working society of natural history in the University, and the Boston Society of Natural History, one of the largest and most efficient of the American institutions of this nature, is also open to all students of the science. —N. S. S.

THE HASSLER EXPEDITION:—We arrived here the 11th of April and all well. We left Montevideo Feb. 28th, and after spending several days very profitably in Gulf Matias we steamed south with fair weather rounding Cape Virgin on the 13th of March and anchoring the first night after in the Straits of Magellan. Lateness in the season obliged us to put off the anticipated trip to Falkland Islands. We started from Possession Bay, our first anchorage, the day after, stopping at Elizabeth and Santa Magdalena Islands and arrived March 16th at Sandy Point, which is the only settled place on the Straits and contains a population of about one thousand. Leaving these on the 19th (Mar.) we steamed on, anchoring every night in some good harbor, passing Cape Froward, our most southern point, on the 20th and reaching the entrance to Smyth Channel on the 27th when we turned north and left the Straits of Magellan. Our trip through was a most interesting and charming one to us all, and many valuable geological observations were made by Prof. Agassiz. Our zoological collections were very satisfactory excepting the fishes which, owing to the steep rocky shores and abundance of kelp prevented our using to advantage our well fitted seines and we were not so successful as we anticipated; the short stay there also limited our collecting, but as a whole the time spent there was very pleasant and enabled us to reap much scientific information. The Straits

are bordered on either side by mountains one or two thousand feet high with their tops more or less covered with snow from which were flowing glaciers. I could count six extensive glaciers in sight above me at one time. In passing we had a favorable opportunity to examine the rocks for evidence of a once existing Glacial Period, corresponding to that seen in the north, and Prof. Agassiz made his observations with perfect satisfactory results. The mountains on both sides showed unmistakable evidence of a large glacial mass of ice once pushing its way south northwards. We stopped one afternoon at Glacier Bay to visit the grand glacier which is moving slowly down the valley from the snow on the mountains, the accumulations of winters, and from which the Bay receives its name. The glacier was at least four miles long, two hundred feet thick and one mile wide at the termination. The progress of the mass down the valley was ascertained to be three eighths of an inch per hour. All the necessary observations were carefully made by Prof. Agassiz.. From the Sraits of Magellan we steamed inland up Smyth Channel and saw, for the first time, the Pacific at the outlet of Gulf of Pénas. Touching at two ports on Chiloe Island we went to Lota for coal and arrived here on the afternoon of the 11th inst. We shall remain here several weeks and there is a favorable prospect for our making a large collection of specimens.—J. HENRY BLAKE. *U. S. C. S. Steamer, Talcahuana, Chili, April* 13, 1872.

WE call attention to the card of Mr. Sanborn, the well known entomologist so long connected with the Massachusetts State Board of Agriculture and the Boston Society of Natural History. To one who has not had practical experience in the matter it will seem odd to be told that in order to receive an answer to inquiries relating to "bugs" that a fee must be enclosed just the same as if he was asking for information from a lawyer or a doctor, but when it is remembered that the inquiries not only often call for several hours of the valuable time of the person addressed, but, also, often involve great pecuniary interests, the matter is put in its true light. While every scientist is ready to give such aid as is in his power to students, out of pure love for his science and a desire to advance it, still there are constant demands on his time made by parties who have simply a pecuniary end in view, and for such to pay for their information is simply justice to the men who have by long and hard study become able to answer them.

ANSWERS TO CORRESPONDENTS.

M. B., Milwaukee, Wis.—The earth sent in the box was so dry when received that the larvæ said to be there could not be found. They were probably larvæ of a small fly. Tie a piece of gauze round the flower pot and upon the stem of the plant, and catch some of the insects when they develop.

AMATEUR, Pembina.—Not unless you send better specimens, neatly put up. Nos. 1 and 2 we happened to recognize. 1, *Peucedanum fœniculaceum* Nutt. 2, *Cymopterus glomeratus* DC. But they should be collected after the fruit is formed. Same of 3, which is *Carex filifolia* Nutt.

BOOKS RECEIVED.

The Bird Fancier's Companion. 16mo. 1871. New York and Boston.

Fifth Report of the Commissioner of Fisheries of the State of Maine, for the year ending 1871. 8vo pamph. 1872. Augusta.

The Development of Limulus Polyphemus. By A. S. Packard, Jr. 4to. 56 pages. 3 plates. 1872.

Contributions to the Fauna of the New York Croton Water. Microscopical observations during the years 1870-1. By Charles F. Gissler. 8vo. pp. 23, woodcuts and 5 plates. New York. 1872.

Vegetable Parasites and the Diseases caused by their growth upon man. By James C. White. 8vo. pp. 50. Boston. 1872.

Journal of the Quekett Microscopical Club. No. 18. Apr., 1872. London.

Nova Acta Regiæ Societatis Scientarum Upsaliensis. 4to. Ser. 3. Vol. vii. Fasc. i,-ii 1869-70. Upsaliæ.

Astronomical and Meteorological Observations made at the United States Naval Observatory during the year 1869. 4to. 1872. Washington.

Philosophical Transactions of the Royal Society of London. 4to. Vol. 160. Parts I-II, 1870. Vol. 161. Part I. 1871. London.

The Royal Society List, 30th Nov., 1870. 4to pamph.

Second Annual Report of the Commissioners of Fisheries of the State of New Jersey. 8vo pamph. 1872. Trenton.

On Organic Physics. By Henry Hartshorne. 8vo. Read before the American Philosophical Society, Jan. 19th, 1872.

Discovery of Additional Remains of Pterosauria, with descriptions of new species. Discovery of the Dermal Scutes of Mosasauroid Reptiles. (From the Amer. Jour. of Science and Arts. Vol. iii., April, 1872.) By O. C. Marsh. 8vo pamph. New Haven.

Report of the Geological Survey of the State of New Hampshire. By C. H. Hitchcock. 1871. 8vo pamph. Nashua.

On the Mode of the Natural Distribution of Plants over the Surface of the Earth. (Boston Soc. Nat. Hist.; First Walker Prize Essay.) By Albert N. Prentiss. 8vo pamph. 1872. Ithaca.

Notice of a New Species of Hadrosaurus. By O. C. Marsh. Received March 21st, 1872.

The General Principles of Organization and the Evolution of Organic Forms. First annual address before the Alumni Society of the medical department of the University of Nashville. Delivered Feb. 23, 1870. By Jerome Cochran. 8vo pamph. 1871. Nashville.

Remarks on a paper entitled "On Some Phases of Modern Philosophy," by Eli K. Price. By Edward D. Cope. 8vo pamph. 1872.

On the Mineral Resources of North Carolina. By Frederick A. Genth. 8vo pamph. 1871. Philadelphia.

Eleventh Annual Report of the Educational Department of Kansas. 8vo. 1871. Topeka.

Preliminary Description of Hesperornis regalis, with notices of four other new species of cretaceous birds. By Prof. O. C. Marsh. (From the Am. Jour. of Science and Arts, May, 1872.)

Geologischen Reichsanstalt. Band xxi. No. 3. Juli, August, September. 4to. 1871. Wien.

The American Journal of the Medical Sciences. 8vo. No. 126. April, 1872. Philadelphia.

Verhandlungen der k. k. geologischen Reichsanstalt. 8vo. No. 11. 1871.

Notice of the Address of T. Sterry Hunt before the American Association at Indianapolis. By James D. Dana. (From the Am. Jour. of Science and Arts.) Feb., 1872.

Annual Report of the Minnesota Historical Society to the Legislature of Minnesota for the year 1871. 8vo. 1872. St. Paul.

Conchological Memoranda. No. ix. By R. E. C. Stearns. (From Proc. Cal. Acad. Nat. Sci. Sept. 4, 1871.)

Record of a few Molds in the Collections of E. C. Howe found in N. Y. 1872.

Botanical Notes. By Thomas Meehan. (Proc. Acad. Nat. Sci. Philadelphia.) 1872.

Le Naturaliste Canadien. Vol. iv. Nos. 1, 2, 3, 4 and 5. 1872. Quebec.

The Canadian Entomologist. Vol. iv. No. 2. 1872. London.

The Entomologist's Monthly Magazine. No. 92. Jan., 1872. London.

The Journal of Botany, British and Foreign. New Series. Vol. i. Nos. 109-113.

The Canadian Naturalist and Quarterly Journal of Science. New Series. Vol. vi. Nos. 2 and 3.

The American Journal of Science and Arts. Third Series. Vol. iii. No. 15. 1872. New Haven.

Nature. Nos. to May 2, 1872. London.

The Academy. Nos. for March and April, 1872. London.

Land and Water. Nos. from Jan. to May. 1872. London.

The Field. Nos. from Jan. to May. 1872. London.

The Lens. Vol. i. No. 2. 1872. Chicago.

Feuille des Jeunes Naturalistes. Nos. 15, 17, 18 and 19. 1872.

La Revue Scientifique. Serie 2. Nos. 34-45. 1872. Paris.

Bulletin of the Torrey Botanical Club. Vol. ii. No. 12. Vol. iii. Nos. 1, 2, 3 and 4. Jan. to Apr. 1872. New York.

American Journal of Conchology. Vol. vii. Part 3. 1871-'72. Philadelphia.

The Scottish Naturalist. Vol. i. No. vi. 1872. Perth.

The Geological Magazine. Vol. ix. No. 4. April, 1872. London.

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THE FEDIAS OF THE NORTHERN UNITED STATES.

BY PROF. THOS. C. PORTER.

About thirty years ago, two Fedias with fruits of singular shape were discovered by Mr. Sullivant, near Columbus, Ohio, and published by him as new species under the names of *F. umbilicata* and *F. patellaria*. They soon disappeared from their original station, and no botanist seems to have met with either of them again until the Rev. S. W. Knipe of the Delaware Water Gap collected, in the spring of 1870, a few specimens of *F. patellaria*, in Westmoreland County, Pa., and early in June, 1871, a large supply in the neighborhood of Columbia on the Susquehanna River, where it grew in great profusion along with the *F. radiata* of Michaux.

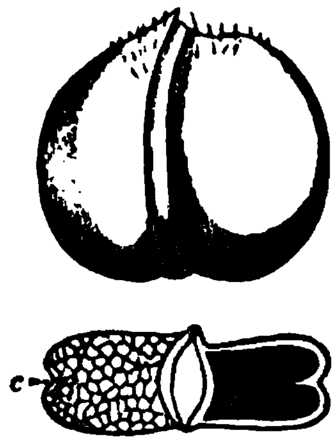
Specimens of this plant, placed in my hands by the collector, exhibited such diversities in the fruit as to suggest the idea that both it and *F. umbilicata* might in the end prove to be forms of *F. radiata*. Dr. Gray, to whom the conjecture was communicated, kindly furnished fruits from Mr. Sullivant's plants, to complete the chain of evidence, and the information that *F. umbilicata* had also been rediscovered, last summer, on the Hudson River.

The Manual of Dr. Gray contains five species of Fedia; one an introduction from Europe (*F. olitoria* Vahl.), and four indigenous. All of them are much alike in general appearance, and amongst the latter especially the resemblance is so great that their specific characters are derived from the fruit alone; but how far these char-

acters are constant and reliable, it will now be my endeavor to show, aided by illustrations from the p ncil of Mr. Knipe.

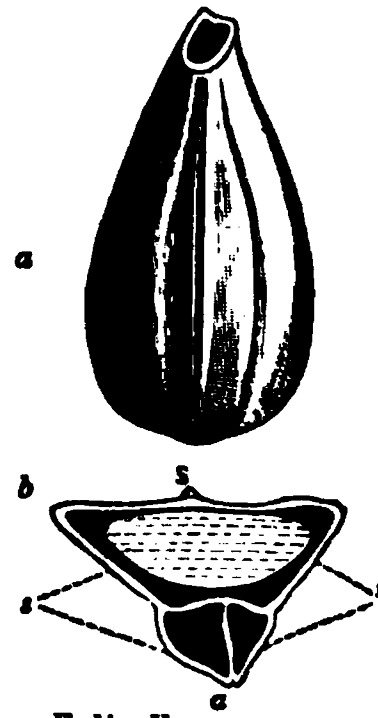
Fedia olitoria Vahl., Fig. 102. Fruit; *a*, side view; *b*, cross section with the confluent empty cells shaded. The spongy mass (*c*) on the back of the fertile cell clearly separates this naturalized foreigner from our native species. It differs also in its more humble and diffuse habit, and the pale blue color of its corolla.

Fig. 102.



Fedia olitoria.

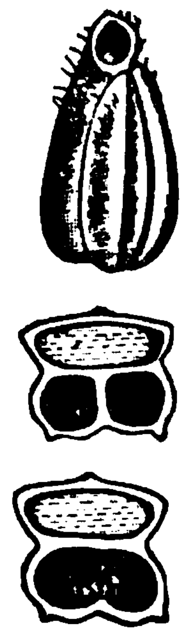
Fig. 103.



Fedia Fagopyrum.

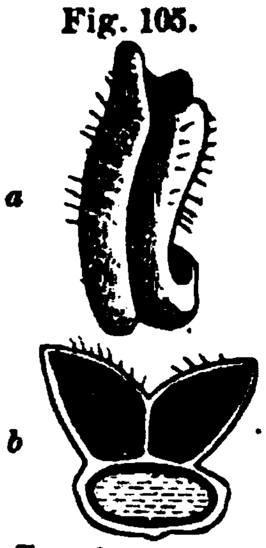
Fedia Fagopyrum Torr. and Gray. Fig. 103. Fruit (from West Penn.); *a*, side view; *b*, cross section, with the two empty cells shaded. Despite the smaller number of stigmas, the structural plan of the ovary, as seen in the five well-defined dorsal sutures (103 *b*, *s*), is quinary. A single ovule is developed and fills up the cavity of the three posterior confluent cells. The two anterior sterile cells are compressed laterally, until they *almost* meet in a sharp angle, making the fruit triquetrous like a grain of buckwheat. Between the sharp edges of the angle a narrow groove (103 *b*, *a*) runs from base to apex. In a considerable number of matured fruits examined, from W. Penn. and W. N. York, this groove was found uniformly present. All, too, were more or less downy under a lens, and in no case were the sterile cells confluent. These are variations from the typical plant as characterized in Gray's Manual, and yet the peculiar shape of the fruit and its large size (two lines in length) will probably enable it to hold its place as a distinct species.

Fig. 104.



Fedia radiata.

Fig. 105.



F. radiata, var. *patellaria.*

Fedia radiata Michx. Fig. 104. Fruit; *a*, side view; *b*, cross section, with the two empty cells shaded; *c*, cross section of another fruit, with the two empty cells confluent. The fruit of this species is much smaller, about a line in length, and usually quite downy, but sometimes smooth. The quinary structure of the ovary is not so apparent. As in all these Fedias the bracts are more or less strongly ciliated, or perfectly

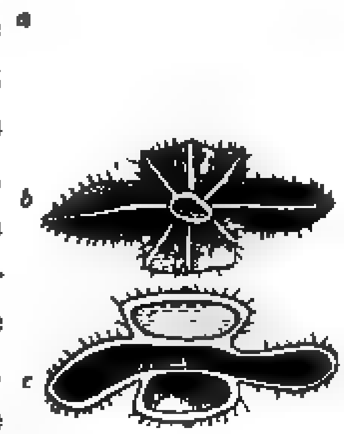
naked. In one particular the description should be amended. Under favorable circumstances it often attains the height of thirty inches, and its range of stature is about that of *F. Fagopyrum*, one to two feet.

Fedia radiata Michx., var. *patellaria* (*F. patellaria* Sulliv.). Fig. 105. Fruit (from Columbia, Pa.); *a*, side view; *b*, cross section, with the two slightly divergent empty cells shaded. This small form varies but little in size and shape from the fruit of genuine *F. radiata* as seen in Fig. 104, *a* and *b*, and appears to have been derived from it by a moderate extension of the walls of the empty cells.

Fig. 106.

F. radiata var. *patellaria.*

Fig. 107.



F. radiata, var. *patellaria.*

Fig. 106. Fruit (from Columbia, Pa.); *a*, side view; *b*, cross section, with the two widely divergent empty cells shaded. Here the abnormal lateral extension of the walls of the empty cells is carried to an extreme, and they are so flattened in the centre and curved up on the margins as readily to suggest the image of a miniature platter. This is exactly the form of fruit in Mr. Sullivant's plant in Dr. Gray's herbarium. Fig. 107. Fruit (from Columbia, Pa.); *a*, side view; *b*, end view above; *c*, cross section, with the empty cells shaded. One specimen of Mr. Knipe's last collection has this remarkable form of fruit throughout. It seems to have been produced by the doubling of that represented in Fig. 106. Two fruits have coalesced by the union of their anterior empty cells, and the dissepiments vanishing have left a single large cell in the middle. On one side the usually fertile cell is empty; on the other, it contains a seed but in some cases *all the cells* are sterile.

Fig. 108.

F. radiata, var. *umbilicata.*

Fedia radiata Michx., var. *umbilicata* (*F. umbilicata* Sulliv.). Fig. 108. Fruit (from Columbus, Ohio); *a*, side view; *b*, another side view, showing the cruciform opening caused by the tendency of the cell in the abnormal expansion of its walls to split along the sutures; *c*, cross section of the same; *d*, side view of a more mature fruit, showing a further enlargement of the opening into the empty cell; *e*, another side view. As the fruit of the former variety came probably from that of *F. radiata*, with two empty cells, as seen in Fig. 104 *b*, so this may have been derived, by the operation of the same cause, from that of Fig. 104 *c*, with the empty cells confluent.

In view of the decided disposition toward monstrosity evident in Fig. 107, and the differences of the fruits in size and shape, it is questionable whether *F. patellaria* and *umbilicata* are worthy to stand even as varieties of *F. radiata;* but, since no typical fruits of the latter have been observed intermingled with the aberrant forms on the same stalk, they may for the present be recognized as such.

MIMICRY IN THE COLORS OF INSECTS.

BY DR. H. HAGEN.

Having observed that in treating of the interesting phenomena of mimicry, writers have used indiscriminately very different factors, I shall try to give some preliminary ideas which I do not find published, and which I believe will be useful in explaining this interesting subject.

It will be best to consider the color and pattern separately. There are three different kinds of colors: viz., colors produced by interference of light, colors of the epidermis, and colors of the hypodermis. All three may either be wanting, or all three, or two of them may occur together in the same place.

Colors produced by interference are produced in two different ways; first by thin superposed lamellæ, as in the wings of Diptera, Neuroptera, etc., without any other color, as in hyaline wings, or connected with other colors as in the scales of Entimus and others.

There must be at least two superposed lamellæ to bring out

colors by interference, and there cannot be more than four, as both wings and scales consist only of four layers, two internal belonging to the hypodermis, two external belonging to the epidermis. In fact, if scales taken from dry specimens of Entimus are observed under the microscope, many partly injured can be found, which give different colors according to the layers of the lamellæ which remain.

Secondly, colors by interference are produced by many very fine lines or striæ in very near juxtaposition, as in Apatura and other color-changing insects. Colors by interference may perhaps be sometimes also produced in the same way as in the feathers of the dove's neck by very small impressions situated near together.

The colors produced by the interference of light are only optical phenomena, differing in this respect from the other colors of the body, the epidermal and hypodermal colors.

The epidermal colors belong to the pigment deposited in the cells of the chitinized external skin, the epidermis. These colors are mostly metallic blue, green, bronze, golden, silver, black, brown, and perhaps more rarely red. The epidermal colors are very easily recognized, because they are persistent, never becoming obliterated or changed after death.

The hypodermal colors are situated in the non-chitinized and soft layer, called hypodermis by Weismann. They are mostly brighter and lighter, light blue or green, yellow, milk white, orange and all the shades between. The hypodermal colors *in the body* of the insect fade or change, or are obliterated after the death of the insect. A fresh or living insect when opened may easily be deprived of the hypodermal colors simply by the action of a little brush. I said hypodermal colors in the body, because there are hypodermal colors which are better protected, being encased nearly air-tight, and therefore are more easily preserved even after the death of the insect. I refer to the colors in the elytra and wings, and in their appendages, the scales. The elytra and the wings are, as is well known, at first open sacs in communication with the body, of which they are only the extension: of course they are formed of the epidermis and hypodermis which become so strongly glued together after the transformation into the imago state that a maceration of years tried by me showed no effect at all on such wings. This fact is very interesting as it explains how wings, and even colored wings, can be found in palæontological

layers in good preservation. The destruction of insects, which is so peculiar to the secondary strata in England, proves, as I believe, that the bodies of the insects must have floated a very long time before they were deposited. It is quite a rarity to find well preserved insects there although many very well preserved wings even of lace-winged flies have been described.

There is an interval after the transformation before the membranes of the wings become inseparably glued together; it is at this time that the finishing of the colors takes place. For instance in an Æschna, a *Libellula depressa* or *trimaculata*, if the wing is cut off at the base, the two layers can be easily separated by manipulation under water, and the wing can be inflated with a little tube by separating the borders with a knife. I can show specimens so prepared. But this is only possible as long as the wings possess the appearance of having been dipped into mucilage, an appearance which is well known in young Odonata.

The scales have just the same development as the wings. At first they are little open sacs, communicating with the hollow of the wing and the whole body, and at a later period are glued together like the wings themselves.

In the wings and in the scales the hypodermal colors are formed and finished before the wings stick together, and by this means they are well preserved and safely encased. They have no more communication in the glued parts with the interior of the animal, and are preserved in the same way, as if hermetically inclosed in a glass tube. There are even here in the wings and scales many epidermal colors, chiefly the metallic ones; but all the brighter colors (for instance the somewhat transparent spots in the elytra of the Lampyridæ, Cicindelidæ, etc., and in the greater number of Lepidoptera) are, as I believe, hypodermal colors.

Finally there sometimes occurs outside of the animal, that is, on the epidermis, a kind of color which I consider as hypodermal color, such as the pale blue on the abdomen of many Odonata, the white on the outside of many Hemiptera, the pale gray on the elytra and thorax of the Goliathus beetle, the powder on Lixus and others. Some of these colors are very easily resolved in ether, and are apparently a kind of wax. I believe that these colors are produced by the hypodermis and are exuded through the little channels of the pores (*Poren Canœle*).

The hypodermal colors are very often different in males and

females of the same species, the epidermal colors rarely differ so far as I know; but there are genera with prominent epidermal colors which are nearly always different in different sexes, viz., Calopteryx, Lestes, some Hymenoptera, etc.

It would be interesting to know the different colors of the epidermis in such cases. So far as I know the change seems to be between related and not between complementary colors. But my observations are far from having any conclusive importance. The same investigation would be necessary for the hypodermal colors.

The hypodermal colors may change or be altered in some way in a male or female during its lifetime, by sexual or other influences. The epidermal colors never change. By sexual influences yellow is changed into orange, brown into red, and even sometimes more changed. By other influences, for instance by cold in hibernation, pale yellow is changed into red (Chrysopa). The hypodermal colors can be changed even by a voluntary act of the animal, and the new colors disappear again (Cassida). The hypodermal colors are the only ones on which the animal has any influence either involuntarily by the action of the nutritive fluid or voluntarily. The epidermal cells are placed entirely outside of any influences of the animal, when once established. It will perperhaps be possible to prove that the so-called mimetic colors are all hypodermal colors.

The hypodermal colors seem to be produced by a photographic process (I know no better expression), the epidermal colors by a chemical process of combustion or oxidation. Would it be possible to prove that by a photographic process even the colors of the surrounding world could be transmitted, a great step towards an undertaking of the phenomena would be given. The fact of course is very probable, at least in some instances.

In observing the mimicry, the pattern of an insect must be clearly separated from the color. In fact the pattern is not the product of an accidental circumstance, but apparently the product of a certain law, or rather the consequence of certain actions or events in the interior of the animal and in its development. The proof is very easily afforded by the regularity of the pattern in a genus, or a family of insects. If studied carefully and comparatively the pattern in a genus is the same or is only more or less elaborated. The number of such families is so exceedingly great that some example will readily occur to every one.

Moreover a certain and constant pattern can be found for the head, a different pattern for the segments of the thorax, and a different pattern for the segments of the abdomen. This pattern is in the different segments of the abdomen (Hymenoptera, Diptera, Neuroptera, Orthoptera) always the same, only more or less elaborated, and less finished in the first and last segments. In some way the same is true for the thoracic segments.

In some few instances I was able to observe how the pattern is produced. In the Odonata (Dragon flies) at the moment of transformation the thorax is transparent, and shows no colors at all. At this time the muscles are without importance and in process of formation. The thoracic muscles as is well known are, in the Odonata, very powerful, and also very extraordinary as regards the shape of their tendons. Just along outside the muscles are dark lines more or less well finished, and resulting from the action of the muscles. *Ubi irritatio, ibi affluxus.* I believe that it would not be unphilosophical to conclude that a powerful action in the development of the muscles is in such a case the cause of a greater combustion or oxidation in the neighboring parts. In fact on the head of a Cicada, on the abdomen of an Æschna we find similar patterns, in some way mostly representing the underlying muscles. In the Gomphina the fact is striking and far more as the stronger species mostly possess a larger dark pattern. There are some very small species which are almost entirely yellow; there are no small species entirely black.

Should the fact, with the explanation, be admitted, a step farther in the explanation of the different patterns would be made. I know very well that in the Odonata there are patterns which do not agree with my explanations, even some contrary to it, but if some certain facts be explained, there are perhaps more factors still unknown or unobserved. The explanation given for certain facts would still be admissible, or at least not entirely objectionable.*

* So far as I know the literature relating to the phenomena of mimicry, all these related differences are often confused, and I believe that in separating them and following the views above given, many facts would be better understood and this interesting subject more easily advanced.

Besides all the difficulties which oppose a clear and correct view, there is one more which I do not find mentioned, *i. e.* the so called color-blindness and the different degrees of it. Prof. B. A. Gould in his excellent work "Investigations on Anthropological Statistics of American Soldiers" has given attention to it in a very remarkable chapter. Persons who cannot distinguish ripe cherries upon the tree, or strawberries

The patterns on the wings and elytra could not be the product of the action of muscles, but I believe it to be probable that the sudden rush of blood or even air, by the accelerated circulation and respiration in the act of transformation may have the same effect. In this way some patterns, otherwise not explicable, could be understood. The eyespots in the caterpillars of some Papilionidæ have been ascertained by Leydig to be epidermal colors, and I believe that the various kinds of eyespots in the wings of the imago are also epidermal colors. If a stream of blood meets a small obstacle just in the centre, a funnel is formed; if this obstacle is a ring, and behind it another obstacle we have two or more funnels, one in the other, and the section of them will be circular or elliptical according to the angle at which they reach the surfaces. Such patterns in the elytra and wings are formed or preformed at the time when the wing is a sac; sometimes before the transformation, and here is another circumstance which explains some patterns. The walls of the sac are suddenly augmented and strongly dilated in the transformation. Small patterns preformed in the sac will also be altered and enlarged by the same process, and I know that many patterns of Lepidopterous wings are in such a way very easily explained. All the waved lines of the wings and other marks belong here, and as the ribs or nervures seem to grow faster in transformation, the waved appearance would be explained. In fact the greater part of the patterns seem to be produced by expansions or distraction of the pattern preformed in the wing at some period before the transformation.

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on the vine by their color are far more numerous than would be suspected. Serious misunderstandings and even calamities have been reported in the army, resulting from mistakes in the color of green and red light by officers of the signal corps." He gives the statement that usually one in twenty, and in the soldiers examined one in fifty was subjected to color-blindness. But these numbers show only the extremes and it is easy to believe that a much greater number are morè or less affected with it. In fact we have no means of measuring this physiological difference; if two persons call something green, and even compare the color with certain known objects there is no proof at all that they see just the same color. I think that it would be prudent in describing cases of mimicry, especially when they are extraordinary, not to forget that even the best observer may be unaware of this infirmity, and in fact the best authorities on color-blindness always state that the greater number of persons have no idea of their infirmity.

ORNITHOLOGICAL NOTES FROM THE WEST.

BY J. A. ALLEN.

III. NOTES ON THE BIRDS OF THE GREAT SALT LAKE VALLEY.

WE arrived at Ogden, Utah, September 1st, and spent the following five weeks ornithologizing in the northeastern portion of the Great Salt Lake Valley. Although the vicinity of Ogden was the principal field of our operations, we made several excursions to the neighborhood of Salt Lake City, and to different points along the eastern shore of the lake. During this time we collected or observed nearly one hundred and forty species of birds, indicating for this locality a comparatively rich avian fauna. From the lateness of the season several of the summer birds had already migrated southward, among these Bullock's oriole and the white pelican. The latter, from its great abundance in summer, forms an interesting feature of the ornithology of the Great Salt Lake Valley. Other species were daily arriving from the mountains or from more northern districts.

The country about Ogden presents unusually varied conditions of locality and climate. The Wahsatch Mountains rise abruptly near the eastern shore of the lake, and some of the peaks are, even in summer, dotted with fields of snow. The broad expanse of water formed by the lake is bordered at intervals with extensive marshes, between which and the mountains stretches a broad arid plain. The willows and cottonwoods that fringe the rivers formerly constituted the only arborescent vegetation in the valley, but now extensive orchards and the numerous trees planted for shade and ornament furnish more favorable haunts for various woodland birds, which are every year increasing in number. While in the valley the summer is almost tropical, a journey of a few hours may take one to the alpine region of the mountains;—from the burning sands of the arid plain to fields of perpetual snow. There is thus as great a variety of localities and climate as can be often found in so limited an area.

The heat throughout the month of September was to us very oppressive, the temperature being that of a New England July; and no rain, it is said, had fallen for nearly four months. During

the first week of October the first snow of the season began to cover the higher parts of the mountains, extending lower with each successive storm, till on the 7th of the month their whole slopes were covered, and rain and sleet fell in the valley. The winds became cold and chilling, and winter seemed to have succeeded summer without the intervention of autumn. Such indeed this year was almost literally the case.

A little more than twenty years ago, as everybody doubtless knows, the Great Salt Lake Valley was entirely a desert, its characteristic vegetation being the "sage brush" and "grease wood," and such similar well-known plants as are found throughout the more excessively arid parts of the West. During the time that has since elapsed the mountain streams have been tapped by the industrious Mormon emigrants, and a portion of their waters conducted in ditches over the plains; thereby literally transforming the barren desert into fruitful fields. Considerable areas have thus been reclaimed, orchards and farms that rival in productiveness those of the most favored portions of our country replacing the repulsive sage brush and its kindred plants. These changes have of course greatly modified the fauna, increasing the number of all the smaller birds, but especially the granivorous and frugivorous kinds, whilst the influx of settlers has materially reduced the number of the water-fowl, although their abundance still forms the most characteristic ornithological feature of the region. Three species are reported to have been recently introduced, which give promise of multiplying rapidly and becoming thoroughly naturalized. These are the European house sparrow (*Passer domesticus*), the common eastern quail (*Ortyx Virginianus*), and the California quail (*Lophortyx Californicus*), all of which, as I was informed, had raised young the past season (1871).

With these general remarks I now pass to a hasty enumeration of the species that came under our observation; premising, however, that the only previous paper especially devoted to the ornithology of this region consists of a brief report by Professor Baird on the birds collected by Captain Stansbury's Expedition,* published in 1852, in which are mentioned thirty-one species.

Of the family of Thrushes, we obtained but four species — the robin, the catbird, mountain mockingbird and hermit thrush. The latter only came down from the mountains about October 1st,

* Stansbury's Expedition to the Great Salt Lake, pp. 314-325.

and we saw but few specimens, but the others were abundant. The robin was formerly rare, but being a general favorite with the settlers it has been carefully protected and seems to be annually increasing in numbers. The mountain mockingbird, familiarly known to the settlers as the "gray bird," is said to have similarly increased, but through its depredations on the smaller fruits—even the peach not escaping its ravages—it has become a proscribed race. The catbird we found as numerous in the thickets bordering the streams as we ever saw it in the East. The arctic bluebird is well known as a spring and autumn visitor, but seems to be most numerous in spring. The titlark (*Anthus Ludovicianus*) abounds at the same seasons, being first observed by us September 15th, though it probably breeds on the neighboring snowy summits of the Wahsatch Mountains. Of the *Sylvicolidæ* or wood-warblers, we collected about a dozen species. The Maryland yellow-throat, the summer yellowbird (*Dendrœca æstiva*), and the yellow-breasted chat are probably common summer residents in the valley; the Blackburnian, Audubon's, the Nashville, the golden-crowned (*Helminthophaga celata*) Macgillivray's and the black-capped flycatching warblers, are all doubtless more or less common at the same season in the adjoining mountains. Nearly all were common in September in the vicinity of Ogden. The ruby-crowned kinglet became frequent about October 1st in the valley, as it had been previously in the mountains. The American ouzel (*Cinclus Mexicana*) was abundant along the mountain streams, and the rock wren was very numerous everywhere on the rocky declivities of the mountains about Ogden, above the upper terrace of the valley. The black-capped chickadee (*Parus atricapillus*, var. *septentrionalis*) was an abundant inhabitant of the willow thickets bordering the Ogden and Weber Rivers, and the reedy marshes were the favorite haunts of thousands of marsh wrens (*Cistothorus palustris*). All the swallows disappeared soon after our arrival; the most frequently observed species being the barn swallow, though the rough-winged and the violet-green were both frequently noticed during the first week of September. The nests of the cliff swallow seen adhering to the cliffs, especially in Weber and Echo Cañons, indicated that this species was also an abundant summer visitant. The red-eyed, warbling, and solitary vireos were all well represented and formed the only species of their family we saw. The cedar bird, the loggerhead shrike, and

the Louisiana tanager were each more or less frequent. The horned lark, so characteristic of the Plains, was also numerous.

The *Tyrannidæ* were well represented, the western race of the wood pewee being abundant, as were also two species of *Empidonax*, one being the western race of the yellow-bellied, and the other a representative of the least pewee of the East. The king-bird and the Arkansas flycatcher were also both frequently observed during the first half of September, and two specimens of the olive-sided pewee were taken.

The great family of the sparrows and finches (*Fringillidæ*) was represented by eighteen species, the greater part of which were common. One half are strictly western, while the others are common species in the Atlantic States. Among the latter were the bay-winged, savanna, the yellow-winged, chipping, song and Lincoln's sparrows, the common gold-finch or yellow bird, and the purple finch, all but the last named being either common or exceedingly abundant. Of the western species, the western white crowned, or Gambel's sparrow, appeared in the valley in great numbers about September 15th; a few specimens of the slate-colored sparrow (*Passerella* "*schistacea*") were seen at about the same date, and the Oregon snowbird became common towards the close of the month. Bell's sparrow (*Poospiza Bellii*) was rather numerous on the dry plains, keeping on the ground among the sage brush. The western gold-finch (*Chrysomitris psaltria*) was also quite numerous, associating freely with the common species; and a few specimens of the lazuli finch were also taken. The arctic towhee (*Pipilo* "*arcticus*") was an abundant inhabitant of the thickets, in habits strongly resembling the common towhee of the East; though its song is somewhat similar to that of the eastern bird, its call note is totally different, quite nearly resembling the call note of the catbird. Blanding's finch (*Pipilo chlorurus*) began to appear in numbers about September 20th, from its breeding haunts in the mountains. The clay-colored sparrow (*Spizella pallida*) was generally found in company with the chipping sparrow, and was almost equally abundant. The black-headed grosbeak is a summer resident, but like its eastern congener, the rose-breasted, departs early for the south, and had already migrated when we arrived. It is well known as the "Pea-bird," from its fondness for green peas, of which it is so destructive that it is considered an obnoxious species.

The *Icteridæ*, or blackbirds, grackles and their allies, were represented by five or six species, of which three, the yellow-headed, red-winged and Brewer's, occurred in immense numbers. The yellow-headed and red-winged live in the marshes, from which at this season they make excursions in great flocks over the neighboring country, by their voracity and numbers causing no little loss to the farmers, by destroying the ripening corn. The Brewer's blackbird, though less an inhabitant of the marshes, to a considerable extent associates with them, and is only less destructive because less numerous. The immense flocks of these associated species bring vividly to mind the descriptions of Wilson and others of the hordes of red-wings and grackles that occur in autumn and winter in the more southern portions of the Atlantic States. The meadow lark is the next most abundant species of this group. The cowblackbird, though perhaps occurring, was not observed, but to our great surprise the bobolink was quite frequent. Bullock's oriole is also a common summer resident, taking the place of our familiar Baltimore of the East.

Among the *Corvidæ*, the raven and the magpie were both common, the latter near the streams and the former more generally distributed; the great-crested, Woodhouse's and the Canada jays were of frequent occurrence in the mountains, the former being familiarly known as the "mountain jay." The common crow is said also to be common, but it escaped our notice.

Nuttall's whippoorwill was abundant on the lower parts of the mountains, and we heard scores of them near the mouth of Ogden Cañon on several occasions, after nightfall. Though so numerous, all our efforts to procure specimens were futile, as it did not usually manifest its presence till after it became too dark for it to be clearly distinguished. We saw the last one October 7th, during a severe snow-storm on the mountains north of Ogden, the snow having already accumulated to the depth of several inches. The snow had probably surprised the bird as much as its own presence under such peculiar circumstances did us. The night hawk and the broad-tailed humming bird were both common through the greater part of September, and the kingfisher is doubtless a common resident throughout the year.

The woodpeckers, owing to the scarcity of woodland, were sparsely represented. Only two species were noticed, one of which, apparently the downy woodpecker, was seen once, and the

other, the red-shafted, was only moderately common. Its evident habit here of sometimes breeding in banks, in the absence of suitable trees, has already been mentioned.* The only owls noticed were the burrowing (*Athene hypogœa*), which in the absence of the prairie dogs lives in the holes of coyotes; and one specimen of the long-eared owl; the great horned owl is said to be of frequent occurrence, especially in the winter. The marsh hawk was abundant, and often seen swooping down over the marshes at the blackbirds, but, generally unsuccessfully, the blackbirds rising in clouds before it with a heavy noise not unlike low distant thunder, soon to settle again in another part of the marsh. The pigeon hawk and the duck hawk were both frequent, the latter preying upon the water fowl. A ruddy duck, struck down and killed by one of these birds, was added one day to our game bag and made a good specimen and the hawk narrowly escaped the same fate. The sparrow hawk, however, was by far the most numerous of the *Falconidæ;* thirty were seen in the air at one time near the mouth of Weber Cañon, engaged in the capture of the "hateful grasshopper" (*Caloptenus spretus* Uhler), which everywhere filled the air, and which seems at this season to form the principal food of this and other birds. The red-tailed hawk, and the golden and white-headed eagle were more or less frequent, and the fish hawk is said to be a rather common summer resident. The turkey vulture was also common.

The Carolina dove was abundant, and is said to breed here, also, generally on the ground.† But few grouse were seen, though evidence was obtained of the presence of four species;—the dusky and the ruffed grouse (*Tetrao obscurus* and *Bonasa umbellus*) in the mountains, and the sage cock and the sharp-tailed on the plains, specimens of the last two being obtained. The sage cock and the sharp-tailed grouse were formerly very abundant, but this year we saw only about a dozen of each, and were informed that it never was known to be so scarce here before.

Of the plovers, the killdeer was the only one seen, and was exceedingly abundant. About a dozen species of *Scolopacidæ* were obtained, of which the greater part were numerously represented.

*This Journal, May, p. 274.

† Prof. O. C. Marsh has informed me that he "can confirm my statement [in the May NATURALIST] that the Carolina dove *breeds on the ground*. In Western Kansas and in Colorado," he adds "I have often found the eggs, and young on the ground. Once I flushed a female who was covering a couple of very young birds on the ground,—not in a nest but in a small depression *on the bare ground*."

Wilson's snipe was so abundant that Mr. Bennett bagged fourteen in the space of a few hours. The red-breasted sandpiper became common after September 25th. The greater yellow-legs and the red-backed sandpiper were also common; whilst the spotted, solitary and least sandpipers and the lesser yellow-legs were only occasionally met with. Wilson's phalarope, the avocet, and the black-necked stilt were abundant and characteristic birds, being summer residents and breeding abundantly on the islands and shores of Salt Lake. The last two are called "white snipes!" Of the avocet we saw flocks of thousands on the sand bars and mud flats at the mouth of Weber River. The glossy ibis (called "black snipe!") is now a common summer bird, but we were assured it had only made its appearance here during the last few years. The white ibis seems to be also a common summer species, which we saw, however, but once; and the greater part of the glossy ibises had migrated before our arrival. Of the seven specimens seen we obtained five, although we found it an excessively wary bird.

Of herons we saw the great blue, and obtained the night heron and the bittern, all of which were tolerably common; and cranes are said to occur in abundance in spring and fall. Of rails, the Virginia, the Carolina, and the marsh hen (*Rallus elegans*) were apparently the most common, though few of either were seen. The mud-hen or coot, however, was found in all the ponds and lagoons in great numbers.

The abundance of the swimming birds is even now almost incredible, though they are far less numerous and much more wary than formerly. Thirteen species of ducks were obtained without special effort, all of which were common, and about one-third were abundant, as follows:— the pintail, green-winged teal, red-breasted teal, gadwall and red-head were each abundant, whilst the mallard, shoveller, widgeon, wood duck, scaup duck, ruddy duck and goosander were common. The Canada goose was also numerous, and the snow goose or "white-brant" began to arrive in considerable numbers about October 1st. Two species of grebe were also noticed, the horned and the Carolina, the latter being abundant. Three species of *Laridæ* were obtained, two of which were seen only after about October 1st. These were the Sabine's gull, of which but a single specimen was either taken or seen, and Bonaparte's gull. The three adult specimens taken of the latter

differ from the eastern representatives of that bird in having a much shorter, thicker and less decurved bill. The Delaware gull, or its western representative, is a numerous summer resident, breeding on the islands in great numbers. At the time of our visit these birds spent much of their time on the sand bars of the Weber River, below Weber Cañon, and at certain hours of the day rose into the air to feast on the grasshoppers, on which they seemed at this time almost wholly to subsist. The stomachs of those we killed were not only filled with them, but some had stuffed themselves so full that the grasshoppers could be seen on opening their mouths. But what seems most singular is the fact that they capture them in the air (not by walking over the ground, as has been stated), sailing around in broad circles as though soaring merely for pleasure, seizing the flying grasshoppers with the same ease that a swallow exhibits in securing its prey of smaller insects while in rapid flight, but of course with far less gracefulness of motion.

Two other interesting birds found here are the double-crested cormorant and the white pelican, the former bearing the singular local name of "black brant!" We saw the cormorants only on Weber River, but, according to Stansbury, they breed on the islands with the gulls and pelicans. The pelicans leave for the south towards the end of August or early in September. Although we saw no live ones, we found one on our first arrival that had been killed but a few days before by gunners. Concerning the abundance of this and other species of water-fowl on the islands during his survey of the Great Salt Lake, Captain Stansbury, under date of Gunnison's Island, May 8th, 1850, writes as follows:—

"The whole neck and the shores on both of the little bays were occupied by immense flocks of pelicans and gulls, disturbed now for the first time, probably, by the intrusion of man. They literally darkened the air as they rose upon the wing, and, hovering over our heads, caused the surrounding rocks to reëcho with their discordant screams. The ground was thickly strewn with their nests, of which there must have been some thousands. Numerous young, unfledged pelicans, were found in the nests on the ground, and hundreds half-grown, huddled together in groups near the water, while the old ones retired to a long line of sand-beach on the southern side of the bay, where they stood drawn up, like Prussian soldiers, in ranks three or four deep, for hours together, apparently without motion. . . We collected as many eggs as we could carry. That of the gull is of the size of a hen's egg, brown and

spotted; that of the pelican is white, and about as large as a goose egg." (Stansbury's Report, p. 179.)

Again, on page 188, under date of Antelope Island, May 20th, Captain Stansbury observes:—

"Before we passed around the point of Antelope Island, we stopped for a few moments at the little islet near it, where the number of gulls and pelicans was, if possible, greater than we had seen on Gunnison's Island. The whole islet was covered with eggs, chiefly those of gulls, and with innumerable young birds, just hatched, the most of which on our appearance instinctively concealed themselves among the crevices of the rocks, while the parent birds, in countless numbers, anxiously hovered over us, filling the air with their discordant cries. Some young herons and cormorants were also found amid the colony of gulls — the former fierce and full of fight, the latter timid and alarmed, running from their nests to the water, where they endeavored to conceal themselves by persevering but abortive attempts to dive. We filled half a barrel with the eggs, but most of them proved to be bad."

The waters of the Salt Lake, of course, afford these birds no food. That of the pelican, says Stansbury (p. 193), "consists entirely of fish, which they must necessarily obtain either from Bear River, from the Weber, the Jordan, or from the Warm Springs on the eastern side of Spring Valley, at all of which places they were observed fishing for food. The nearest of these points is more than thirty miles distant, making necessary a flight of at least sixty miles to procure and transport food for the sustenance of their young."

In concluding these brief notes on the birds of the West, a few general observations may be added. Probably every observing collector who has had the opportunity of studying birds in their native haunts at widely separated localities has noticed differences in the songs or notes of birds of the same species at distant points in the common habitat of the species. My own experience has been that at southern localities, the songs of certain species are abbreviated, and generally uttered with less energy than at the north. In other cases, garrulous birds, like the jays and some others, have certain common notes at some localities not heard at all at others, when in color or other features they differ but slightly, if at all, there being as it were local dialects in their respective languages. On the other hand, the songs of species that differ widely in color, are sometimes so closely similar as almost to defy the most discriminating ear to detect the species by their songs,

though some of their call notes may be quite different. At other times they differ in habits, especially in respect to the situation and form of the nest, the same species at some localities breeding always on trees and at others almost as uniformly on the ground, in cases where the identity of the species is admitted by every ornithologist. In like manner some that at some localities build domed nests, at others build an open nest; others vary from a somewhat elaborate bulky nest, to a much simpler and more slight one; whilst in all cases the material varies in accordance with the respective abundance of whatever may be most suitable to the wants or habits of the species. Thus, on the Plains, many species line their nests with the soft hair of the buffalo in place of the down from certain plants they are accustomed to choose at other localities.

The question of the occurrence of supposed hybridity among certain of the birds of the West is one of constantly increasing interest. The facts of the case are simply these:—that between several congeneric but widely diverse forms occur individuals over the region where the habitats of the two adjoin, which combine in varying degrees the characteristics of both forms. These individuals have been generally supposed to be hybrids between the forms they respectively resemble, but whether such or not, in a technical sense, they are evidently fertile with either of the original forms, and also among themselves. Furthermore, that on either side of the area of "hybridity," either form exhibits in varying degrees an admixture of the characters of the other, the degree lessening on either hand over an area of usually several hundred miles in breadth, till each form assumes nearly constantly its maximum divergence from the other. Such in general is the nature of what I have termed longitudinal variation, or the differentiation of conspecific forms at localities differently situated in respect to longitude. Similar differentiation occurs at localities differing in latitude, which hybridity has never been assumed to explain, though it is difficult to see why it should not be called in as well in the one case as in the other. In each case we have a similar gradual differentiation over extensive areas. Hybridity has been generally regarded as an unfailing test of specific diversity, but here one of two things must be assumed:—either that hybridity fails as a test of specific diversity, or else that these widely differing congeneric forms are only geographical modifications of the same

species, resulting from at present only partially known laws of climatic influence. To the latter I incline as being the most rational and the best supported by analogy and by facts.*

NOTE.—In the article on the Birds of Colorado, in the June number of this Journal, I omitted to add that several specimens of the white-throated wren (*Catherpes Mexicanus*) were obtained near Colorado City, where it was a common species. This is the first time, apparently, that this species has been reported from any point within the United States east of Southern Nevada (*Ridgway*). It possesses a voice of wonderful strength and penetration for so small a bird, and seemed to delight in the startling echoes it awakened among the high cliffs of the "Garden of the Gods."

On page 350, June number of this Journal, it was stated that *Chamea fasciata* was apparently common near Colorado City. As it has been heretofore known only from the extreme southwestern portions of the United States, I should perhaps add that no specimens were taken, but as I was within a few yards of it on a number of occasions, I cannot doubt the correctness of the observation.

I take this opportunity of correcting the following *errata*: On page 345, line 12, *read* chipping *for* "nipping;" p. 347, line 28, read *Selasphorus* for "*Selasophorus*;" p. 350, line 3, read *tephrocotis* for "*griseinucha*;" p. 351, line 6, read *Actodromas Bairdii* for "*Pelidna Americana*."

VISIT TO THE ORIGINAL LOCALITY OF THE NEW SPECIES OF ARCEUTHOBIUM IN WARREN COUNTY, N. Y.

BY C. C. PARRY, M.D.

HAPPENING to spend a few days in the vicinity of Glen's Falls, N. Y., I concluded to improve the opportunity of visiting the locality of the newly discovered species of *Arceuthobium* (*A. minutum* Engel. ined.) parasitic on *Abies nigra*.

I accordingly called on Mrs. Lucy Millington of the above place, to obtain the desired information as to the precise locality where it was first found. It is to this lady that the botanical world is indebted for the discovery of this interesting addition to the Flora of New York. Mrs. Millington's first specimens were collected on the 10th of August, 1871,† and were then recognized by her as a distinct parasite of which she could find no account in any of the botanical works at her command. Specimens were accordingly

*On climatic variation see Bull. Mus. Comp. Zoöl., Vol. ii, No. 3, and Vol. iii, No. 6, where the subject is further discussed, and where most of the facts on which the above remarks are based are given in detail.

†A brief record of Mrs. Millington's discovery has been given on page 166 of this volume of the NATURALIST.—Eds.

transmitted to Mr. Leggett of the Torrey Botanical Club of N. Y., where it was first brought to the notice of Dr. Torrey. Later in the season the same species was also found by Mr. Peck, in a peat marsh near Sand Lake in the vicinity of Albany, N.Y. Subsequently Mrs. Millington collected and transmitted numerous specimens in different stages of growth, from the original locality in Warren Co., N. Y., to Dr. Engelmann of St. Louis, who has been engaged for some time, in working up a monograph of the North American Species of *Arceuthobium.*

For the benefit of future explorers of the botany of this northern district, I cannot do better than indicate the exact locality of this interesting plant as first pointed out by Mrs. Millington, viz.: — About two miles north of Warrensburg, Warren Co., N. Y., following the plank road leading to Chester, you pass on the right hand (east) of the road, an extensive marshy track, which on penetrating a narrow belt of timber, opens up into a wide sphagnous swamp occupied with occasional clumps of Samarack, and bordered by low stunted growths of black spruce (*Abies nigra*). Here the plant in question may be found without difficulty, the first indication of its presence being observable in distorted branches showing at their extremity a massed growth of finely divided spray, having a somewhat faded foliage. These masses will, on closer inspection, reveal the minute parasite, occupying the upper or thrifty growing branches. Of other points worthy of mention, I may note briefly.

1st. The period of flowering (different from most other species of the genus) is in spring. At the time of my visit, May 14th, the male blossoms were fully opened and the pollen mostly shed; the female flowers also well developed.

2d. As far as my observation goes, the plant is strictly diœcious, males and females occupying separate trees: not even occurring on different branches of the same tree. The male plants seem to be most frequent, though female plants are not rare.

3d. The parasitic growth, whether male or female, seems to persist on the same branch extending upwards, year by year on the thrifty growing branches; leaving only the scars of previous growths on the lower portions of the limb; the distortion being evidently due to this cause.

4th. Neither male nor female plants persist beyond the period

of flowering, or perfecting their seed, after which the minute shoots (seldom an inch in length and very rarely branched) drop off, leaving a persistent cup-shaped base.

The technical characters of this species will be fully developed in Dr. Engelmann's forthcoming monograph of the genus.

ON THE WYANDOTTE CAVE AND ITS FAUNA.

BY PROF. E. D. COPE.

THE Wyandotte Cave traverses the St. Louis Limestone of the carboniferous formation in Crawford County in south western Indiana. I do not know whether its length has ever been accurately determined, but the proprietors say that they have explored its galleries for twenty-two miles, and it is probable that its extent is equal to that of the Mammoth Cave in Kentucky. Numerous galleries which diverge from its known courses in all directions have been left unexplored.

The readers of the NATURALIST have freshly in their memories the interesting papers of Messrs. Packard and Putnam on the fauna of the Mammoth Cave and related species. The writer accompanied the excursion so pleasantly described in the NATURALIST, and obtained most of the species there enumerated as well as two or three additional ones which will be mentioned at the close of this article. On returning to Indianapolis at the request of Prof. E. T. Cox, state Geologist of Indiana, I made an examination of the Wyandotte Cave, so far as two days' exploration could be called such. Having prepared my report, I present a portion of it, by permission of Prof. Cox, to the NATURALIST.

The Wyandotte Cave is as well worthy of popular favor as the Mammoth. It lacks the large bodies of water which diversify the scene in the latter, but is fully equal to it in the beauty of its stalactites and other ornaments of calcite and gypsum. The stalactites and stalagmites are more numerous than in the Mammoth, and the former frequently have a worm or maccaroni-like form, which is very peculiar. They twist and wind in masses like

the locks of Medusa, and often extend in slender runners to a re-remarkable length. The gypsum rosettes occur in the remote regions of the cave and are very beautiful. There are also masses of amorphous gypsum of much purity. The floor in many places is covered with curved branches, and, what is more beautiful, of perfectly transparent acicular crystals, sometimes mingled with imperfect twin-crystals. The loose crystals in one place are in such quantity as to give the name of "Snow Banks" to it. In other places it takes the form of japanning on the roof and wall rock.

In one respect the cave is superior to the Mammoth—in its vast rooms, with step-like domes, and often huge stalagmites on central hills. In these localities the rock has been originally more fractured or fragile than elsewhere, and has given way at times of disturbance, piling masses on the floor. The destruction having reached the thin-bedded strata above, the breaking down has proceeded with greater rapidity, each bed breaking away over a narrower area than that below it. When the heavily-bedded rock has been again reached, the breakage has ceased, and the stratum remains as a heavy coping stone to the hollow dome. Of course the process piles a hill beneath, and the access of water being rendered more easy by the approach to the surface, great stalactites and stalagmites are the result. In one place this product forms a mass extending from floor to ceiling, a distance of thirty or forty feet, with a diameter of twenty-five feet, and a beautifully fluted circumference. The walls of the room are encrusted with cataract-like masses, and stalagmites are numerous. The largest room is stated to be 245 feet high and 350 feet long, and to contain a hill of 175 feet in height. On the summit are three large stalagmites, one of them pure white. When this scene is lit up, it is peculiarly grand to the view of the observer at the foot of the long hill, while it is not less beautiful to those on the summit. There is no room in the Mammoth Cave equal to these two.

I must not omit to mention the kind attention to the wants of his guests constantly displayed by Mr. Conrad, the present proprietor of the hotel, and the equally useful guidance of Mr. Rothrock, the owner of the cave. Visitors will also find on their way thither an American Auerbach's hotel at Leavenworth, near the steamboat landing. This excellent house is not haunted, like its European predecessor at Leipsic, by either a Mephistophiles or a Faust, but by a landlord (Mr. Humphreys), whose charges are

low, and whose wife knows how, in lodgings and table, to satisfy reasonably fastidious persons.

An examination into the life of the cave shows it to have much resemblance to that of the Mammoth. The following is a list of sixteen species of animals which I obtained, and by its side is placed a corresponding list of the species obtained by Mr. Cooke and others at the Mammoth Cave. These number seventeen species. As the Mammoth has been more frequently explored, while two days only were devoted to the Wyandotte, the large number of species obtained in the latter, suggests that it is the richer in life. This I suspect will prove to be the case, as it is situated in a fertile region. Some of the animals were also procured from caves immediately adjoining, which are no doubt connected with the principal one.

Of the out-door fauna which find shelter in the cave, bats are of course most numerous. They are probably followed into their retreat by the eagle and other large owls. The floors of some of the chambers were covered to a considerable depth by the castings of these birds, which consisted of bats' fur and bones. It would be worth while to determine whether any of the owls winter there.

I believe that wild animals betake themselves to caves to die, and that this habit accounts in large part for the great collections of skeletons found in the cave deposits of the world. After much experience in wood craft, I may say that I never found the bones of a wild animal which had not died by the hand of man, lying exposed in the forest. I once thought I had found the place where a turkey vulture (*Cathartes aura*) had closed its career, on the edge of a wood, and it seemed that no accident could have killed it, the bones were so entire as I gathered them up one by one. At last I raised the slender radius; it was broken, and the only injured bone. I tilted each half of the shaft, and from one rolled a single shot! The hand of man had been there. One occasionally finds a mole (*Scalops* or *Condylura*) overcome by the sun on some naked spot, on his midday exploration, but if we seek for animals generally, we must go to the caves. In Virginia I found remains of very many species in a recent state; in a cave adjoining the Wyandotte I found the skeleton of the gray fox *Vulpes Virginianus.* In a cavern in Lancaster Co., Pennsylvania, in an agricultural region, I noticed bones of five or six *Cistudines*, as many rabbits, and a few other wild species, with dog, horse, cattle, sheep, etc., some of which had fallen in.

LIST OF LIVING SPECIES IN THE TWO CAVES.

Wyandotte.		Mammoth.
	Vertebrata.	
Amblyopsis spelæus DeKay.		Amblyopsis spelæus DeKay.
		Typhlichthys subterraneus Girard.
	Arachnida.	
Erebomaster flavescens Cope.		Acanthocheir armata Tellk.
		Phrixis longipes Cope.
Anthrobia.		Anthrobia monmouthia Tellk.
	Crustacea.	
Orconectes inermis Cope.		Orconectes pellucidus Tellk.
Cæcidotea microcephala Cope.		Cæcidotea stygia Pack.
Cauloxenus stygius Cope.		Stygobromus vitreus Cope.
	Insecta.	
Anophthalmus tenuis Horn.		Anophthalmus Menetriesii Motsch.
Anophthalmus eremita Horn.		Anophthalmus Tellkampfii Erichs.
Quedius spelæus Horn.		Adelops hirtus Tellk.
Lesteva sp. nov. Horn.		
Raphidophora.		Raphidophora subterranea Scudd.
Phora.		Phora.
Anthomyia.		Anthomyia.
Machilis.		Machilis.
Campodea sp.		Campodea Cookei Pack.
Tipulid.		
	Myriopoda.	
Spirostrephon cavernarum Cope.		Scoterpes Copei (Pack.).

The blind fish of the Wyandotte Cave is the same as that of the Mammoth, the *Amblyopsis spelæus* DeKay. It must have considerable subterranean distribution, as it has undoubtedly been drawn up from four wells in the neighborhood of the cave. Indeed, it was from one of these, which derives its water from the cave, that we procured our specimens, and I am much indebted to my friend N. Bart. Walker, of Boston, for his aid in enabling me to obtain them. We descended a well to the water, some twenty feet below the surface, and found it to communicate by a side opening, with a long low channel, through which flowed a lively stream of very cool water. Wading up the current in a stooping posture, we soon reached a shallow expansion or pool. Here a blind crawfish was detected crawling round the margin, and was promptly consigned to the alcohol bottle. A little further beyond, deeper water was reached, and an erect position became possible, We drew the seine in a narrow channel, and after an exploration under the bordering rocks secured two fishes. A second haul secured another. Another was seen, but we failed to catch it, and on emerging from the cave I had a fifth securely in my hand, as I thought, but found my fingers too numb to prevent its freeing itself by its active struggles.

If these Amblyopses be not alarmed, they come to the surface

to feed, and swim in full sight like white aquatic ghosts. They are then easily taken by the hand or net, if perfect silence is preserved, for they are unconscious of the presence of an enemy except through the medium of hearing. This sense is, however, evidently very acute, for at any noise they turn suddenly downward and hide beneath stones, etc., on the bottom. They must take much of their food near the surface, as the life of the depths is apparently very sparse. This habit is rendered easy by the structure of the fish, for the mouth is directed partly upwards, and the head is very flat above, thus allowing the mouth to be at the surface. It thus takes food with less difficulty than other surface feeders, as the perch, etc., where the mouth is terminal or even inferior; for these require a definite effort to elevate the mouth to the object floating on the surface. This could rarely be done with accuracy by a fish with defective or atrophied visual organs.* It is therefore probable that fishes of the type of the *Cyprinodontidæ*, the nearest allies of the *Hypsæidæ*, and such *Hypsæidæ* as the eyed *Chologaster*, would possess in the position of the mouth a slight advantage in the struggle for existence.

The blind crawfish above mentioned is specifically distinct from that of the Mammoth Cave, though nearly related to it. Its spines are everywhere less developed, and the abdominal margins and cheles have different forms. I call it *Orconectes inermis*, separating it generically from *Cambarus*, or the true crawfishes, on account of the absence of visual organs. The genus *Orconectes*, then, is established to include the blind crawfishes of the Mammoth and Wyandotte Caves. Dr. Hagen, in his monograph of the American Astacidæ, suspects that some will be disposed to separate the *Cambarus pellucidus* as the type of a special genus, but thinks such a course would be the result of erroneous reasoning. Dr. Hagen's view may be the result of the objection which formerly prevailed against distinguishing either species or genera whose characters might be suspected of having been derived from others by modification, or assumed in descent. The prevailing views in favor of evolution will remove this objection; and for myself I have attempted to show † that it is precisely the structural characters which are most obviously, and therefore most lately, assumed

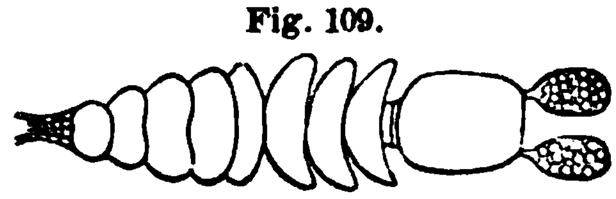
* Mr. Putnam's objection to my reasoning from the structure of the Amblyopsis' mouth was based on a misconception of my meaning. The above explains the point more fully.

† Origin of Genera, p. 41.

on which we have been in the habit of depending for discrimination of genera. The present is a case in point. So far also as the practice of naturalists goes, this course is admissible, for the presence or absence as well as the arrangement of the eyes have long been regarded as generic indications among the Myriopoda and Arachnida. Without such recognition of a truly structural modification our system becomes unintelligible.

Dr. Packard described in his article already quoted, an interesting genus of Isopoda allied to the marine form *Idotœa*, which Mr. Cooke discovered in a pool in the Mammoth Cave. He called it *Cœcidotea*. I obtained a second species, in a cave adjoining the Wyandotte, which differs in several important respects. The head is smaller and more acuminate, and the bases of the antennæ are more closely placed than in *C. stygia* Pack. I call it *Cœcidotea microcephala*. Both species are blind. The new species is pure white. It was quite active, and the females carried a pair of egg pouches full of eggs. The situation in which we found it was peculiar. It was only seen in and near an empty log trough used to collect water from a spring dripping from the roof of one of the chambers.

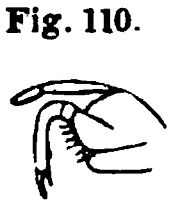
Fig. 109.



Cœcidotea microcephala Cope, magnified 6.5 times.

The Lernæan, *Cauloxenus stygius* Cope, is a remarkable creature. It is a parasite on the blind fish, precisely as numerous species near of kin, attach themselves to various species of marine fishes. The Wyandotte species is not so very unlike some of these. It is attached by a pair of altered fore-limbs, which are plunged into the skin of the host and held securely in that position by the barbed or recurved claws. The position selected by the blind fish Lernæan, was the inner edge of the upper lip, where she hung in a position provocative of attempts at mastication on the part of the fish and reminding one of the picture of the man on the ass' back holding a fork of fodder before the animal's nose, in illustration of the motto that "persuasion is better than force." The little creature had an egg pouch suspended on each side, and was no doubt often brought in contact with the air by her host.

Fig. 110.

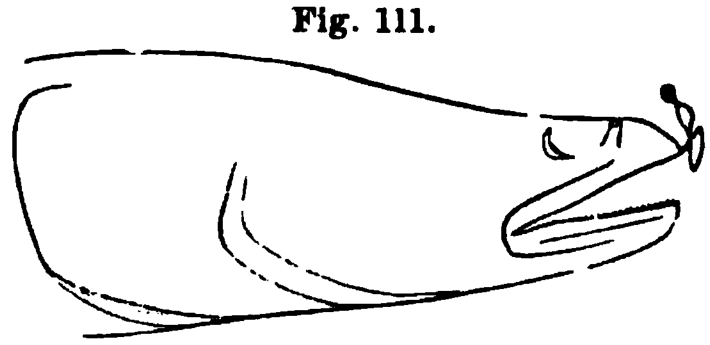


Cæcidotea microcephala Cope. The mandible and palpi of right side more enlarged. The outer palpus lies above the lateral plate, and its origin was not seen.

This position would not appear to be a favorable one for long life, as the body of the *Cauloxenus* would be at once caught

between the teeth of the fish, should its direction be reversed or thrown backwards. The powerful jaw-arms, however, maintained like a steel spring a direction at a strong angle with the axis of the body, which was thrown upwards over the upper lip, the apex of the cephalothorax being between the lips of the fish. This position being retained, it becomes a favorable one for the sustenance of the parasite, which is not a sucker or devourer of its host, but must feed on the substances which are caught by the blind fish, and crushed between its teeth. The fragments and juices expressed into the water must suffice for the small wants of this crustacean.

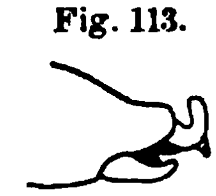
Fig. 111.



Cauloxenus stygius in position on the lip of *Amblyopsis spelæus*, enlarged.

But if the supply of food be precarious, how much more so must be the opportunities for the increase of the family. No parasitic male was observed in the neighborhood of the female, and it is probable that as in the other *Lernæopodidæ*, he is a free swimmer, and extremely small. The difficulty of finding his mate on an active host-fish must be augmented by the total darkness of his abode, and many must be isolated owing to the infrequent and irregular occurrence of the fish, to say nothing of the scarceness of its own species.

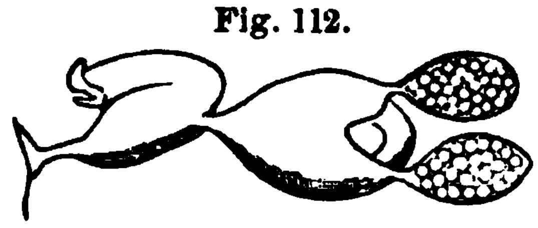
Fig. 113.



Cauloxenus stygius. Antennal processes and muzzle more enlarged.

The allied genera, *Achtheres* and *Lernæopoda*, present very distinct distributions, the former being fresh water and the latter marine. *Lernæopoda* is found in the most varied types of fishes and in several seas; *Achtheres* has been observed on perch from Asia and Europe, and on a South American *Pimelodus*. It is to the latter that *Cauloxenus* is most nearly allied, and from such a form we may perhaps trace its descent; modification being consequent on its wandering into subterranean streams. The character which distinguishes it from its allies, is one which especially adapts it for maintaining a firm hold on its host, *i. e.* the fusion of its jaw-arms into a single stem.

Fig. 112.



Cauloxenus stygius. The animal viewed from below, with an infero-lateral view of the cephalothorax.

Whether the present species shared with the *Amblyopsis* its history and changes, or whether it seized upon the fish as a host at some subsequent period, is a curious speculation. Its location

at the mouth of the fish could scarcely be maintained on a species having sight, for if the host did not remove it, other individuals would be apt to.

I may here allude to another blind Crustacean which I took in the Mammoth Cave, and which has been already mentioned in the Annals and Magazine of Natural History as a Gammaroid. Mr. Cooke and myself descended a hole, and found a short distance along a gallery, a clear spring covering, perhaps, an area ten feet across. Here Mr. Cooke was so fortunate as to procure the *Cæcidotea stygia*, while I took the species just mentioned, and which I name *Stygobromus vitreus*. The genus is new and represents in a measure the *Niphargus* of Schiödte found in the caves of Southern Europe. It resembles, however, the true *Gammarus* more closely, by characters pointed out at the close of this article. This genus has several species in fresh waters, which are of small size, and swim actively, turning on one side or the other.

Of insects I took four species of beetles, all new to science. Two of them of the blind carnivorous genus *Anophthalmus*, and two *Staphylinidæ*, known by their very short wing-cases and long, flexible abdomen. Dr. Geo. H. Horn has kindly determined them for me. One of them, the *Quedius spelæus* Horn, is a half-inch in length, and has rather small eyes.* It was found not far from the mouth of the cave. Dr. Horn furnishes me with the following list of Coleoptera from the two caves in question:

Anophthalmus Tellkampfii Erichs.	Mammoth Cave.	
" Menetriesi Motsch. *angulatus* Lec.	Mammoth Cave.	
" eremita Horn.	Wyandotte Cave.	
" tenuis Horn.	Wyandotte Cave.	
" striatus Motsch.	Mammoth Cave.	Unknown to me.
" ventricosus Motsch.	Mammoth Cave.	Unknown to me.
Adelops hirta Tellk.	Mammoth Cave.	

These are the only true cave insects at present known in these faunæ. Other species were collected within the mouths of the caves, but which cannot be classed with the preceding, as cave insects proper.

Catops n. sp.?	Wyandotte Cave.
Quedius spelæus Horn.	Wyandotte Cave.
Lesteva n. sp.	Wyandotte Cave.

And another Alæocharide Staphylinide, allied to Tachyusa, also from Wyandotte Cave. No names have as yet been given to

*See Proceed. Amer. Entom. Soc., 1871, p. 332.

any of these excepting the second. A monograph of Catops has already appeared containing many species from our fauna, and as the work is inaccessible at present, I have hesitated to do more than indicate the presence of the above species.

The cricket of the Wyandotte Cave is stouter than that of the Mammoth and thus more like the *Raphidophora lapidicola* of the forest. There were three species of flies, one or more species of *Poduridæ* and a *Campodea* not determined.

Centipedes are much more abundant in the Wyandotte than in the Mammoth cave. They especially abounded on the high stalagmites which crown the hill beneath the Mammoth dome, which is three miles from the mouth of the cave. The species is quite distinct from that of the Mammoth Cave and is the one I described some years ago from caves in Virginia and Tennessee. I call it *Spirostrephon cavernarum*, agreeing with Dr. Packard that the genus* to which it was originally referred is of doubtful validity. The species is furnished with a small triangular patch of eyes, and is without hairs, but the antennæ are quite elongate. Its rings are quite handsomely keeled. The allied form found by Mr. Cooke in the Mammoth Cave has been described by Dr. Packard as *Spirostrephon Copei.* It is eyeless and is, on this account alone, worthy of being distinguished generically from *Spirostrephon*, though the absence of pores asserted by Dr. Packard, would also constitute another character. *Spirostrephon* possesses a series of lateral pores as I have pointed out in accordance with Wood's view.† This genus may be then named *Scoterpes.* I look for the discovery of *S. cavernarum* in the Mammoth Cave.

Two species of Arachnidans were observed, one a true spider, the other related to the "long-legs" of the woods. A species similar to the former is found in the Mammoth Cave, and others in other caves, but in every instance where I have obtained them, they have been lost by the dissolution of their delicate tissues in the impure alcohol. The other forms are more completely chitinized and are easily preserved. They are related to the genus *Gonyleptes* found under stones in various portions of the country. Dr. Wood describes a species from Texas, and I have taken them in Tennessee and Kansas. In the Wyandotte Cave I found a number of individuals of a new species at a place called the screw hole.

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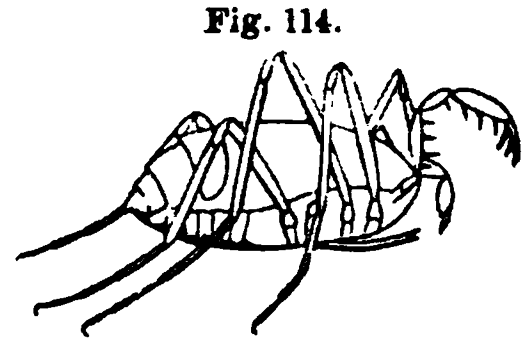
* *Pseudotremia.*

† Proceed. Amer. Entom. Soc. 1870.

This is a narrow passage between masses of rock, which rises from the end of a gallery to the floor of a large room called the senate chamber. Though living at a distance of four or five miles from the mouth of the cave, this species is furnished with eyes. Its limbs are not very long, but its palpi are largely developed, and armed with a double row of long spines pinnately arranged, like its relative of the Mammoth Cave, the *Acanthocheir*. This species is described at the end of the article as *Erebomaster flavescens* Cope. In its relationships it may be said to stand between *Acanthocheir* and *Gonyleptes*.

Fig. 114.

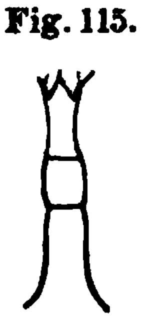


Erebomaster flavescens, magnified 7.6 times.*

Besides *Acanthocheir*, another blind Gonyleptid exists in the Mammoth Cave, which I found several miles from the mouth. It is blind like the former, but differs in having many more joints to the tarsi, approaching thus the true *Phalangia*, or long-legs. There are six joints and terminal claws, while *Acanthocheir* is said to have two and *Erebomaster* three joints. It is larger than *A. armata*, and has much longer legs. Its palpi are also longer and their spines terminate in long hairs. I have named it *Phrixis longipes*.

Dr. Packard and Mr. Putnam have already discussed the question of the probability of the origin of these blind cave animals by descent from out-door species having eyes. I have already expressed myself in favor of such view, and deem that in order to prove it, we need only establish two or three propositions. First, that there are eyed genera corresponding closely in other general characters with the blind ones; second, that the condition of the visual organs is in some cave type variable; third, if the abortion of the visual organs can be shown to take place coincidentally with general growth to maturity, an important point is gained in explanation of the *modus operandi* of the process.

Fig. 115.



Erebomaster flavescens. Male organ from below.

First, as to corresponding forms; the *Typhlichthys* of the Mammoth is identical† with *Chologaster*, except in its lack of eyes.

* Our engraver has not correctly represented the posterior lateral border of the large dorsal scutum. The mandible should also have been represented as terminating in a pair of nippers. — EDS.

† Mr. Putnam shows that the known species of *Chologaster* differ from those of *Typhlichthys* in the lack of the papillary ridges, which is probably another generic character similar to the loss of eyes. The absence in *Chologaster* of minute palatine

Orconectes bears the same relation to *Cambarus; Stygobromus* bears nearly the same to *Gammarus*, and *Scoterpes* is *Spirostrephon* without eyes, and no pores.

Secondly, as to variability. I have already shown that in *Gronias nigrilabris*, the blind Silurid from the Conestoga in Pennsylvania, that while all of several specimens observed were blind, the degree of atrophy of the visual organs varies materially, not only in different fishes, but on different sides of the same fish. In some the corium is imperforate, in others perforate on one side, in others on both sides, a rudimental cornea being thus present. In some, the ball of the eye is oval and in others collapsed. This fish is related specifically to the *Amiurus nebulosus* of the same waters, more nearly than the latter is to certain other Amiuri of the Susquehanna river basin to which the Conestoga belongs, as for instance the *A. lynx;* it may be supposed to have been enclosed in a subterranean lake for a shorter time than the blind fishes of the Western Caves, not only on account of the less degree of loss of visual organs, but also in view of its very dark colors. A feature on which I partly relied in distinguishing the species, has perhaps a different meaning. The tentacles or beards were described as considerably shorter than those of allied species. On subsequently examining a number of individuals, I was struck with the irregularity in their lengths, and further inspection showed that the extremities were in each case enlarged, as though by a cicatrix. I have imagined that the abbreviation of the tentacles is then due to the attacks of carnivorous fishes which inhabit the subaërial waters into which the *Gronias* strays, from whom its blindness renders it unable to protect itself.

Thirdly, it is asserted that the young *Orconectes* possess eyes, and that perhaps those of the *Typhlichthys* do also. If these statements be accurate, we have here an example of what is known to occur elsewhere, for instance, in the whalebone whales. In a fœtal stage these animals possess rudimental teeth like other Cetacea, which are subsequently absorbed. This disappearance of the eyes is regarded with reason by Prof. Wyman as evidence of the descent of the blind forms from those with visual organs. I would suggest that the process of reduction illustrates the law of "retardation," accompanied by another phenomenon. Where characters

teeth, and the presence of an additional pair of pyloric cæca, which he mentions, will be apt to prove only specific.

which appear latest in embryonic history are lost, we have simple retardation, that is, the animal in successive generations fails to grow up to the highest point, falling farther and farther back, thus presenting an increasingly slower growth in this special respect. Where, as in the presence of eyes, we have a character early assumed in embryonic life, the retardation presents a somewhat different phase. Each successive generation, it is true, fails to come up to the completeness of its predecessor at maturity, and thus exhibits "retardation," but this process of reduction of rate of growth is followed by its termination in the part, long before growth has ceased in other organs. This is an exaggeration of retardation. Thus the eyes in the *Orconectes* probably once exhibited at maturity the incomplete characters now found in the young, for a long time a retarded growth continuing to adult age before its termination was gradually withdrawn to earlier stages. Growth ceasing entirely, the phase of atrophy succeeded, the organ become stationary at an early period of general growth, being removed, and its contents transferred to the use of other parts by the activity of "growth force." Thus for the loss of late assumed organs we have "retardation," but for that of early assumed ones, "retardation and atrophy."

In comparing the list of animals from the Wyandotte with that of the Mammoth Cave, it will be observed that the representatives in the former, of two of the blind genera of the latter, are furnished with eyes. These are the *Erebomaster* and *Spirostrephon*, which correspond with the *Acanthocheir* and *Scoterpes* respectively. In the outer part of a branch of the Wyandotte I took two eyed beetles the *Quedius spelæus* and a *Platynus*.

The out-door relatives of the blind forms are various. Those having congeners outside are the *Spirostrephon*, *Campodea*, *Machilis*, *Phora*, *Raphidophora*. Those with near but few allies, the *Scoterpes*, *Amblyopsis* and the three *Gonyleptidæ*. Species of the latter are much more rare in this country than those of *Phalangiidæ*, which are not known from the caves. The *Orconectes* is mostly fresh water in kindred, while Packard shows that those of the *Cæcidotea* are marine. Those of the *Cauloxenus* are partly marine, and those of the *Stygobromus* fresh water and marine.

The mutual relations of this cave life form an interesting subject. In the first place, two of the beetles, the crickets, the centipede, the small crustaceans (food of the blind fish) are more

or less herbivorous. They furnish food for the spiders, craw-fish, *Anophthalmus*, and the fish. The vegetable food supporting them is in the first place fungi, which in various small forms, grow in damp places in the cave, and they can always be found attached to excrementitious matter dropped by the bats, rats and other animals which extend their range to the outer air. Fungi also grow on the dead bodies of the animals which die in the caves, and are found abundantly on fragments of wood and boards brought in by human agency. The rats also have brought into fissures and cavities communicating with the cave, seeds, nuts and other vegetable matters, from time immemorial, which have furnished food for insects. Thus rats and bats have, no doubt, had much to do with the continuance of land life in the cave, and the mammals of the post-pliocene or earlier period, which first wandered and dwelt in its shades were introducers of a permanent land life.

As to the small crustaceans, little food is necessary to support their small economy, but even that little might be thought to be wanting, as we observe the clearness and limpidity of the water in which they dwell. Nevertheless the fact that some cave waters communicate with outside streams is a sufficient indication of the presence of vegetable life and vegetable débris in variable quantities at different times. Minute fresh water algæ no doubt occur there, the spores being brought in by external communication, while remains of larger forms, as confervæ, etc., would occur plentifully after floods. In the Wyandotte Cave no such connection is known to exist. Access by water is against the current of small streams which discharge from it. On this basis rests an animal life which is limited in extent and must be subject to many vicissitudes. Yet a fuller examination will probably add to the number of species and of these, no doubt, a greater or less number of parasites on those already known. The discovery of the little Lernæan shows that this strange form of life has resisted all the vicissitudes to which its host has been subjected. That it has outlived all the physiological struggles which a change of light and temperature must have produced, and that it still preys on the food of its host as its ancestors did, there is no doubt. The blindness of the fish has favored it in the "struggle for existence," and enabled it to maintain a position nearer the commissariat, with less danger to itself than did its forefathers.

Descriptions of Species from the Wyandotte Cave.

ORCONECTES Cope.

Genus novum. Similar to *Cambarus*, but with the eyes rudimental with the cornea small and not facetted The present genus embraces two species, the *O. inermis* of the Wyandotte and the *O pellucidus* of the Mammoth Cave.

O. INERMIS Cope, sp nov. This species is near the *O. pellucidus*, and differs as follows. Its proportions are generally less slender, and the spines less developed. The frontal process is considerably shorter, the terminal spine not extending beyond the apex of the antennal lamellæ and very little beyond the point of bifurcation of the first antennæ. In *O. pellucidus* the spine extends much beyond these points The lateral points mark the middle of the length and support very rudimental spines; they are elongate in *O. pellucidus*. The basal lateral ridges are marked and convergent; basal spines short. The antennal lamellæ are much enlarged at the middle and contracted below, and are furnished with a fringe of long hairs At the base of the second antennæ the margin of the thorax has a projecting convexity moderately developed. On the side of the thorax there is a small patch of weak prickles, and there are two on the anterior lateral suture of the abdomen. In *O. pellucidus* these spines are larger and much more numerous. The lateral outlines of the postabdominal segments are those of one extremity of an ellipse with a slight angulation at the extremity; in *O. pellucidus*, these are rectangular, with the hinder margin straight distally.

Fig. 116.

Orconectes inermis Cope, nat. size.

The cheles are slender, but less so than in *O. pellucidus*, the opposed processes are flat and not ridged along the middle as in that species, and the general surface is smooth or nearly so, without the tubercular roughness of *O. pellucidus*. The cheles of the second and third legs partake of the broader form of the first. The third femora of the third and fourth legs with short hooks The spines of the basal segments of the first legs are much as in the old species The shell of the specimen taken early in September was very soft on the abdominal segment, but well calcified elsewhere. Color white. Total length, head and body, m.054 (= 2¼ in). Length of spine from thorax margin, .0055. Length cheliform segment of first legs, .024; width do., .0075; length movable (last) segment of do., .0123.

The single specimen of this species has been compared with four of the *O. pellucidus* in the Museum of the Academy Natural Sciences, one of which is young; the characters above alluded to are constant. They are also exhibited by Dr. Hagen's figure,* except the slenderness of the cheles, which is less than in our specimens. This figure is copied by Dr. Packard.

CÆCIDOTEA Packard.

C. MICROCEPHALA Cope, sp nov. "Unknown crustacean with external egg-pouches." Cope. Ann. Magaz. Nat. Hist., 1871, November.

* Catalogue of the Museum Comparative Zoology. Monograph of the *Astacidæ* of North America.

Abdominal segments confluent into a single one; thoracic segments seven, well distinguished. Inner antennæ close together, situated between the larger outer ones; both issuing from below the margin of the dorsal plate of the cephalic segment. The specimens are in bad condition, having lost their limbs, egg-pouches and the distal portions of their antennæ. The head is small, narrower and scarcely longer than the first thoracic segment. The segments are all smooth and without hairs or sculpture. The abdominal segment is quadrate-oval, truncate posteriorly, without projection or mucro, above regularly, but slightly convex. Egg-pouches well separated, oval in form, moderate in size. The limbs are given off from the free extremities of the segments. Branchial laminæ extending to the extremity of the abdominal segment, in contact throughout on the median line. Color pure white. Length with egg-pouches, but with only four basal joints of antennæ, 5-16th of an inch (m.0077).

This species is near the *Cæcidotea stygia* of Dr. Packard (American Naturalist, 1871, pp. 751–2) and, as such, of much interest. It has a much smaller and more acuminate head than the *Cæcidotea stygia* Pack., though in general the species are not very different in other respects, and are of about the same size. In the *C. microcephala* the abdomen is truncate, in the longer known species, angulate.

This species may then be regarded as the representative of the *C. stygia* in the Wyandotte Cave.

CAULOXENUS Cope.

Fam. *Lernæopodidæ* Gerst. The adult female stout, sack-like, not articulated. Cephalothorax not elongate, large, separated from the abdomen by a strong constriction. Anchor or jaw-feet elongate, arm-like, closely united throughout their length, originating at or behind the middle of the cephalothorax. Cephalothorax undivided, abdomen rounded, sack-shaped, not segmented. Egg-pouches short, wide.

This genus differs from its allies, *Achtheres* and *Lernæopoda* in the fusion of the jaw-limbs, between which a faint dividing depression only may be distinguished, when they are viewed from below. The form of the abdomen is much as in *Achtheres*, but segmentation is not distinguishable. The short, wide egg-sacks are as in other genera of this family; they are well separated and are filled with large, globular eggs.

The structure of the mouth organs is not readily determinable in my single specimen, owing to the intervention of the very stout jaw-feet. They are only visible in profile (see fig. 112). A pair of perhaps first antennal segments projects from the head, is curved upwards and is without terminal bristle or hook; a short process at the base may represent a tactile appendage. The inferior antennæ are well marked and equally without appendage. There are some bodies between them, perhaps on the middle line, whose nature is not determinable. There is no trace of eyes. The chitinous stem of the common jaw-feet is rather long, and expands discoidally at the extremity.

C. STYGIUS Cope. Proceed. Acad. Nat. Sci., Phila., 1871, p. 297. Cephalothorax nearly as long as abdomen, oval, subcompressed; abdomen subround, subdepressed, separated by a rather long constriction. Egg-sacks rounded, shorter than abdomen, on very short pedicels. Jaw-limbs nearly as wide as the abdomen, and not quite so long, much constricted distally at the point of origin of the anchoring stem, which is nearly as long as the arm proper. No dermal appendages of any kind. Rostral region projecting above the arms, subconical. Color uniform whitish. Length (without anchor-claws) m.003.

EREBOMASTER Cope.

Genus novum, familiæ *Gonyleptidarum*. Cephalothoracic shield extending over a considerable part of the abdomen, which has seven segments. Tarsus with three joints and a terminal claw. Palpi with five joints and a claw, the fourth and fifth with a series of strong spines on each side. Mandibles chelate. Cephalothorax with a median conical eminence, which has an ocellus on each side of its base. Posterior trochanters like the others.

This genus is related to the *Acanthocheir* of Lucas, which has been recently figured in the NATURALIST. According to Wood that genus is eyeless. Dr. Packard's figure presents many peculiarities. Thus the abdomen is not represented as segmented, and there is no distinct cephalothoracic shield; the tarsi are represented as only two-jointed. From this and other facts, I suspect that *Acanthocheir* should be placed near *Erebomaster* among the *Gonyleptidæ*.

E. FLAVESCENS Cope, sp. nov. "Opilio-like Spider," Cope. Ann. Magaz. Nat. Hist., November, 1871. Body smooth, limbs very minutely hairy. Two spines at the extremity of the penultimate tibia. Three or four spines at the base of the third segment of the palpi, not longer than those of the third, which has four on the outer side. Spines of last joint longest. The longest limbs are about twice as long as the total length of the body. Maxillæ rather long. Color a light brownish yellow. Length of head and body m.0025.

In one specimen the male organ is protruded and extends to the mandibular cheles; it is not chitinized and appears to be twice segmented. It terminates in a short point with mucro, which is flanked on either side by a point with two divergent bristles.

ANOPHTHALMUS Sturm.

A. TENUIS Horn. Pale rufo-testaceous, shining. Head slightly darker in color, oval and arcuately biimpressed. Thorax broader than the head, slightly longer than broad,

and sinuately narrowing to hind angles, which are exactly rectangular; median line distinctly impressed in its entire length, basal impression deep; base of thorax truncate. Elytra elongate oval, feebly convex, at base slightly flattened; two-thirds longer than broad, humeri obtusely rounded; surface with feeble traces of striæ and three dorsal setigerous punctures on each elytron, in or nearest to the position of the third stria. Body beneath similar in color to the upper surface, legs somewhat paler. Length .18-.24 inch; 4.5-6 mm.

Three specimens of this species were collected. This species is closely allied to *A. Menetriesi* Motsch. (*angulatus* LeC.), but differs by its more elongate and less robust form and less convex surface. The elytra are smoother and with very feeble traces of striæ. The two species differ especially in the form of the hinder thoracic angles and base of thorax. In *Menetriesi*, the angles are acute, slightly prominent externally and the base of the thorax slightly prolonged, while in the present species the angles are strictly rectangular and the base truncate. This species must be placed near the one just cited in my table of our species (Trans. Ent. Soc., Phil., 1868, p. 126).

The new species above described is the most slender in form of any in our cabinets.

A. EREMITA Horn. — Pale, rufo-testaceous, feebly shining. Head oval, arcuately biimpressed, impressions moderately deep, intervening space feebly convex. Thorax wider at widest portion than long, sides moderately rounded in front, gradually narrowed to base, hind angles rectangular, base truncate and as wide as length of thorax; disc feebly convex, median line distinctly impressed, basal transverse impression moderate. Elytra oval, less shining than thorax and sparsely clothed with very short, erect pubescence; striæ obsolete; three dorsal punctures on the line of the third stria. Length .20 inch; 5 mm.

One specimen of this species was collected with preceding in Wyandotte Cave. The only species with which it might be confounded is that previously described by me under the name *A. pusio*, and although differing very notably on comparison in their general aspect, the points of difference are not easily made plain in a description. The present species is in all respects broader and less depressed, without being convex as in *Menetriesi*: the thorax is broader, less narrowed behind, and the sides more rounded. The elytra are less shining and the pubescence more distinct, although in both species the pubescence can only be observed by holding the specimen between the eye and the light and then only with a good power. In the three species at the head of my analytical table, no signs whatever of pubescence can be observed. The elytral striæ are here also obliterated, faint traces are discernible only at the base. The basal margin is not prolonged.

QUEDIUS Leach.

Q. SPELÆUS Horn. — Pale, rufo-testaceous, shining. Head broadly oval, smooth, shining, slightly impressed between the eyes in front; two punctures bearing short setæ in front of the eyes, another at the side of vertex, two at the side of head behind, hind angle of head slightly pubescent. Eyes not large, nearly round and prominent. Antennæ moderately stout, one-half longer than the head, first joint nearly as long as the second and third together, the third one-half longer than the second; joints 4-10, gradually but feebly stouter, cylindrical and scarcely longer than wide, joint 11, longer than preceding and subacute at tip. Thorax slightly broader than ate elytra, sides distinctly explanate, broader than long, emarginate in front, anterior hngles subacute, sides and base broadly rounded, forming nearly a circle, less the emargination in front; surface smooth, shining and with punctures arranged as follows: a dorsal series of two punctures moderately distant from the anterior margin, a lateral oblique series of three or four punctures, one puncture being within the line of the lateral but not belonging to the dorsal series; a marginal row of moderately large punctures close to the lateral margin extending along the base, the punctures being more distant in the latter region. Prosternal process behind the coxæ corneous. Scutellum smooth, shining. Elytra slightly longer than the thorax, rather densely and moderately coarsely punctured and sparsely clothed with yellowish pubescence. Abdomen moderately elongate, longer than the head, thorax and elytra together, slightly narrowed to apex, moderately punctured but less densely than the elytra, above and beneath sparsely clothed with brownish hairs. Body beneath and legs similar in color to the upper surface. Length .46-.50 inch; 11.5-12.5 mm. Abundantly distinct from all our species by the color and thoracic punctures. The sides of thorax are more explanate than any of our species except *Q. explanatus* LeC.

Two specimens were collected a short distance within the mouth of Wyandotte Cave.

Descriptions of species from the Mammoth Cave.

PHRIXIS Cope.

Genus novum *Gonyleptidarum*. Cephalothoracic shield covering dorsum of abdomen, which is posteriorly segmented. Eyes none. Tarsi multiarticulate, clawed. Palpi spiniferous, maxillæ chelate.

This genus is near *Erebomaster*, differing in the multiarticulate tarsi, and absence of eyes. It is nearer to *Acanthocheir*, being like it eyeless, but the latter according to Dr.

Packard's figure (in AMERICAN NATURALIST, l. c.) has tarsi as in the first named genus, one or two jointed. In *Phrixis* they are much as in *Phalangium*, which the species also resembles in its long limbs.

PHRIXIS LONGIPES Cope, sp. nov. Legs eight times as long as the body, tarsus of the shorter with five, those of the longer with six joints, those of the longest not counted. The first and second segments are very long; tibiæ shorter than femora; coxæ subglobular. Legs with scattered, rather short hairs. Last tarsal joint with one claw and an opposing bristle, in two limbs as long as femora, exceeding total of body, with two claws. Palpi five jointed, the third, fourth and fifth with large spines on each side, the second, or vertical, with four near the base directed forwards and two near the upper end directed inwards. Mandibles pubescent. Five narrow, and one terminal, segments of the abdomen, the penultimate wider than the others. Body pubescent. Color very pale, with a straw-colored shade. Length of body 1.17 lines, or m.00225; longest leg m 02.

This species, though small, considerably exceeds the *Acanthocheir armatus* in dimensions.

STYGOBROMUS Cope.

Gen. nov. *Gammaridarum*. Near *Gammarus*. The first antennæ with flagellum, and much shorter than the second. Two pairs of limbs chelate by the inflexion of the last claw-like segment; other limbs clawed. Terminal abdominal segment very short, spiniferous; the penultimate segment with a stout limb with two equal styles, the antepenultimate short, two-jointed and undivided. Eyes none.

This genus is nearer to the true *Gammarus* than the allied genus described from the Austrian Caves, the *Niphargus* of Schiödte.* In the latter the first antennæ are the larger, and the body terminates in a very long style; the last abdominal limb is undivided like that which precedes it. In *Stygobromus* the penultimate limb is like that represented by Schiödte for *Niphargus*, though I am not certain whether it is homologically identical. The last limb is about equally divided, but the simple basis is long and stout.

It is just possible that the antepenultimate limb represents the basis and one style only, for in that of one side a slight process appears at the extremity of the basal segment, though it is not visible on that of the other. The terminal limbs are recurved and appressed to the last abdominal segment, forming a fulcrum or prop. The animals of this genus are aquatic, and swim much as the common *Gammari*. The absence of eyes is another example of the adaptation to darkness.

STYGOBROMUS VITREUS Cope. "Gammaroid Crustacean" Cope, Ann. Mag. Nat. Hist., Nov., 1871. Two last pairs of limbs appressed to last abdominal bristles and of nearly equal length, forming a brush. Last segment of abdomen with two terminal bristles. Last segment of the limbs from the third to the seventh, with a long, straight claw directed forwards. Fringed limbs behind this point very small. Outer or second antennæ half as long as the first, which embrace eleven segments, and are about as long as the last five abdominal segments. Total length of head and body 2.1 lines or .0045 m.

There are few conspicuous hairs, the most so are those which stand at the extremity of the last joint of the limbs, rising from the base of the claw. Color translucent.

REVIEWS AND BOOK NOTICES.

VEGETABLE PARASITES AS CAUSES OF DISEASE.† — The first of these two papers gives the recent ideas, as seen by an able and advanced observer, in regard to those forms of cryptogamic vegetation whose growth is believed to be the cause of Ringworm, Favus, and a few similar affections. Dr. White discusses the

* Proc. Entom. Soc., London, 1851, p. 150.

† Vegetable Parasites, and the diseases caused by their growth upon man. By James C. White, M.D., Prof. of Dermatology in Harvard University. 8vo pamphlet. Boston. 1872.

On the development of Vegetable Organisms within the Thorax of Living Birds. By Dr. James Murie, F.L.S., etc.; Lecturer on Comp. Anat., Middlesex Hospital. Read before the Royal Microscopical Society, Jan. 3, 1872.

nature and history of these cryptogamia, their relations to each other and to common moulds, and their importance as sources of contagion; while, with much good sense and rare judgment, the question of treatment is quietly left to the professional books.

Dr. White's general introductory view of the microscopic fungi is clear and significant, and forms a convenient ground for the comparison of views even by those whose ideas are inconsistent with it. The nutritive system, or *mycelium*, consists of slender cells or tubes, branched, intertwined, and furnished with occasional transverse partitions. This may increase directly by subdivision into cells with similar powers of branching and of self-multiplication, or by the production at the ends of some of the branches of minute spherical or ovoid cells inclosed in capsules called sporangia, or growing in bushes or bead-like chains, when they are called *conidia* or *spores*. These conidia may be found detached, either single or in rows or compound cells, and are capable of reproducing the mycelium. Under certain conditions the substance, called plasma, of these various forms may become cloudy and divided into infinitely small free cells which multiply by self-division and may exhibit peculiar movements. These cells or points, if more or less spherical, are called *micrococcus*; if somewhat elongated and swollen at one end, bacteria; and if joined in minute chains, vibriones. They have been much and loosely discussed, and are supposed to be the primitive forms of organic life. In suitable fluids they develop into larger cells, single or united and sometimes elongating like mycelium, known as ferment cells. This is the submerged form of fungus life, familiarly observed in the yeast plant and other ferments; and is capable of reversion to micrococcus, or under favorable circumstances may attain to mycelial and conidial development. It closely resembles the spores of ringworm, etc.

These forms make up the structure of the moulds, and their varying size, shape, and predominance have been regarded as specific characters; but recent observations show that such variations may be due to the nature of the soil and atmospheric conditions, and that the recently recognized species are often varieties of well known individuals, prevented from their usual development by circumstances of position. This tendency to variation has been termed pleomorphism.

These low forms of vegetation occasion the processes of fermen-

tation by which important chemical products are obtained; and they change dead matter (so called) into the state best fitted for the support of future generations. They may also live at the expense of the living tissues of plants and animals, although possibly only upon those which are depressed by some cause below a full vital energy. The muscadine of the silk worm and the oidium of the Madeira vineyards are cited as examples of the importance of such destructive agency.

The effects of such fungi upon the surface of men are never fatal, or constitutionally hurtful, but they are greatly annoying and may last for many years. Schœnlein in 1839 first recognized the cryptogamic character of the crusts of Favus; and after much dispute, the following affections are now safely referred to similar causes—Ringworm (in which the author includes as varieties *Eczema marginatum*, *Tinea tonsurans*, *Sycosis*, and *Ringworm of the Nail*) and *Pityriasis versicolor*. Still a subject of dispute is *Alopecia areata*, and *Myringomycosis*, both of which are often accompanied if not caused by cryptogamic growths. On the other hand the *chignon-fungus* and some other controverted cases are safely considered pseudo-parasites.

Several of these parasitic plants are common upon the domestic animals, and in some instances may possibly have been originally derived from them.

On the question of the identity of the several vegetable parasites, and their relations to the common moulds, much study has been expended, and with remarkably contradictory results. Equally safe observers reach the extreme opposite conclusions. The methods of investigation are clinical observation, artificial inoculation, and development of the fungi by cultivation. Clinically favus is distinct, and the others are separable with reasonable certainty: inoculation leads to the same conclusion, notwithstanding the deceptive inferences which may easily be drawn from accidental coincidences: and cultivation, while it usually furnishes an abundance of penicillium, aspergillus and other familiar moulds, is so liable to error from their accidental introduction that it has as yet, in the author's judgment, furnished no sufficient data for admitting the identity of the subjects of the paper with any of the common moulds.

The vegetable parasites are an occasional cause of alterations of the epidermis and its appendages, causing baldness, etc. They

are communicated by actual contact rather than by the aërial transmission of spores; and are therefore usually avoidable by ordinary care. With the exception of the varieties of ringworm, they are comparatively rare. Some, but not all of them, are particularly liable to attack debilitated constitutions. Schools, and especially orphan asylums, and barbers' shops have heretofore furnished most frequently the conditions essential to the spread of these forms of vegetation.

A more curious branch of this subject is the occurrence of vegetable organisms within the closed cavities of living animals. That organisms usually presumed to be dependent upon some parentage for their existence should grow within cavities communicating with the external air, as the stomach for instance, is really a case of external parasitism; as the germs might be easily introduced by the air or otherwise. Of far different importance is the occurrence of such growths within tissues or cavities having no external openings. The presence of parasitic animals in the eye, brain, etc., and of mould within the thorax and other closed cavities of living animals, has seemed to many to have an important bearing upon the question of spontaneous generation. At the present time, however, when the possibility of the passage of solid particles through uninjured living tissues is believed by many if not by most microscopists, the entrance of the germs is no longer incredible.

Dr. Murie reports three new cases of vegetable-like mould found within the thorax of birds. Two of the three birds were known to be ill for a short time before death. No cause of death, unless the fungus be considered such, was known. The cryptogamic growth was in all the cases a greenish white patch upon a thickened and injected portion of the pleural membranes. In one case the lungs exhibited spots of lobular pneumonia. Under a microscope the vegetation revealed linear, interlaced filaments and innumerable echinate circular cells, and under higher powers, oval or elliptical cells distinctly nucleated. Mr. Cooke hinted the possibility that these growths were algæ: but Dr. Murie is convinced that they are a species of *Aspergillus*, of the order Mucedines, the microscopical elements above mentioned being the mycelium and spores of the fungus. Although such appearances have been sometimes considered as of post-mortem production, he believes that the spores were introduced by the breath into the

lungs, penetrated the moist and delicate tissues, and by development occasioned the death of the birds; some antecedent state of the system being admitted as rendering possible the development of the fungus.

Including these new cases, eighteen kinds of birds are recorded as liable to attacks of fungi, either accompanying or causing fatal disease. As they belong to many different groups of birds it may be inferred that the whole class is predisposed to them under special but yet unknown conditions; these moulds, as far as at present definitely determined, belong to two or three species of *Aspergillus*, and derive great importance from the interest at present attached to the investigation and control of cryptogamic causes of disease. —R. H. W.

BOTANY.

Exuberance of Pollen.—For many years I have observed with wonder, in the early summer, or about the month of June, the immense amount of pollen scattered in the vicinities where coniferous trees and shrubs are abundant. On the Great Lakes I have often noticed the surface of the water covered for miles with a thick coating of this yellowish deposit, looking as if it was strewn with sulphur, which in calm weather continued for days together. At times, indeed, it is so difficult to get the water free from the pollen that it is rather unpleasant for drinking, cooking, or washing purposes.

In walking through grounds where the Juniper (*Juniperus communis* Linn.) covered the sterile soil, I have frequently noticed the clouds of golden dust which I raised, and that my boots were yellow from the pollen. What remarkable prodigality this displays on Nature's part. It is difficult to conceive a use for the pollen thus spread over the land and the lake waters; though there may be one hidden from us.

This superabundance of the male principle, which seems to be the rule throughout Nature, is a peculiarly interesting and suggestive fact, and worthy of more investigation and thought than it has heretofore received.

In plants, insects carry off a considerable quantity of the pollen: bees, for example, to make bee-bread; and we may know a few more instances of its use besides its legitimate one of fertilization. But all of these taken together would scarcely make

more than a small fraction of the amount of this life-dust covering with its thick sulphur-colored coat a single square mile of the surface of Lake Huron or Lake Superior.—HENRY GILLMAN, *Detroit, Michigan.*

DOUBLE FLOWERS OF RANUNCULUS RHOMBOIDEUS.—Specimens of this are sometimes found in Floyd County, Iowa, with perfectly double flowers. I have found several plants, and one of these I transferred to a bed in the flower-garden, where it thrived finely and increased to a clump six inches in diameter, which the next spring was perfectly enveloped with the little bright yellow flowers. No seeds were produced; and during the two or three seasons in which the plant was cared for there was no sign of change to single flowers. The plant was quite attractive; and as it blooms very early and profusely, it would seem to have some of the qualities required to entitle it to a place among cultivated flowers.—J. C. ARTHUR, *Iowa Agr. College.*

[To be sure; being a dwarf species, it would be desirable, and Prof. A. might make a little money, while doing a good thing, by propagating the plant, and introducing it through the florists. In acknowledgment of the hint, send us, please, a good root of it.—EDS.]

QUERCUS ALBA, VAR. GUNNISSONII.—In Watson's report, Hall and Harbor's Rocky Mountain *Quercus Douglassii* var. *Neo-Mexicana*, is said to be *Q. alba*, var. *Gunnissonii*. My specimens are as much like Hall and Harbor's as if they had been taken from the same plants. I can therefore speak of the living trees as I saw them, and, without regard to their identity with *Q. Gunnissonii*, would suggest a doubt as to the propriety of their reference to *Q. alba*.

I have had experience with trees in a living state of both European and American species, and the idea left on my mind after journeying several days through tracts on which this oak in question grew, was that it partook more of the character of *Quercus robur* than of *Q. alba*. Among the European species I have noticed a remarkable tendency in some plants of *Quercus cerris* to approach *Q. robur;* and among these Rocky Mountain forms were many which had the leaves and general appearance of the branches much like *Quercus cerris*. This was especially the case with some low growing plants (about three feet high), about a

day's journey north of Pike's Peak. South of Pike's Peak were some nearly fifteen feet high. None had the bark of *Q. alba*, but in other respects favored *Q. robur* rather than *Q. alba*.

I know how easy it is to be mistaken. Though I do not think Mr. Watson is right, I am by no means certain of my own view. I write merely to suggest that full reliance be not placed on this supposed relationship without a fuller examination. A few years ago it would be deemed a matter of very little consequence; but as the question of evolution has risen to such magnitude, such facts as these are worthy of the most careful scrutiny. As a general rule it struck me that, accepting the theory of evolution as true, the plants of the Rocky Mountain region of Colorado favored a derivation from European rather than Eastern American forms, and that this oak was one of the instances.—THOMAS MEEHAN.

THE FORMATION OF OZONE BY FLOWERS.—It has been found by Mantegazza (*Rendiconti del Reale Istituto Lombardo*, vol. iii. fasc. vi., abstracted in *Der Naturforscher*, 27th April) that many essential oils, like that of peppermint, turpentine, oil of cloves, lavender, bergamot, aniseseed, nutmeg, thyme, and others, when in contact with the oxygen of the atmosphere in presence of sunlight, develop very large quantities of ozone. The oxidation of these oils is, in fact, a very convenient source of ozone, as they, even in small quantities, ozonize much oxygen. The action is strongest in direct sunlight, far less so in suffused daylight, and very weak or at an end in the dark. The development of ozone which has been begun in the light continues for a long time in darkness. In the same manner act eau-de-cologne, hydromel, and other aromatic tinctures on exposure to the solar rays. Experiments which Mantegazza has made on flowers with powerful perfume, such as the narcissus, hyacinth, heliotrope, mignonette, and others, in closed vessels, proved that they also form ozone. Those with fainter perfume produced less ozone, those without scent none at all. Mantegazza believes that this important source of ozone is of hygienic value for the purification of the air of marshy districts. —*Academy*.

JUNIPERUS OCCIDENTALIS.—Mr. Watson remarks that this species has not yet been found in Colorado. It grows on the low hills to the eastward of Pike's Peak; not abundantly, but together

with larger quantities of *Juniperus Virginiana*. It here makes but a low stubby tree of from fifteen to twenty feet high; but with very stout trunk in proportion to its low stature.—THOMAS MEEHAN.

WILD DOUBLE-FLOWERED EPIGÆA REPENS is received from Worcester by Mr. Arba Pierce, who has gathered similar flowers from the same plant for several years. The doubling comes from the partial conversion of the stamens into petals, the outer and most transformed series more or less coalescent into a tube.— A. GRAY.

EXPERIMENTS ON HYBRIDIZATION.— Mr. J. Anderson-Henry, one of our most skilful horticulturists, is contributing to "The Garden" the details of some important experiments on pure hybridization, or crossing distinct species of plants. He finds that in those plants which possess two series of stamens, one long and one short, the results vary essentially according as the pollen is used from one or the other series to effect the fertilization. He uses the short stamens only in all cases where he wishes to cross a large on a small species, and with the most successful results. The converse also he finds to hold good, remarkable hybrids being produced by using the long stamens where he wished to cross a small on a large species. The reason of this he considers to be that the shorter stamens contain pollen of smaller grains, and therefore better fitted to emit its tubes through the style to fertilize the ovules of the smaller species, and *vice versâ*. The plants chiefly operated upon by Mr. Anderson-Henry are various species of Geranium, Rhododendron, and Azalea.—*Academy*.

CALYPSO.

(A rare Orchid of the North.)

BY W. W. BAILEY.

Calypso, goddess of an ancient time,
(I learn it not from any Grecian rhyme,
And yet the story I can vouch is true)
Beneath a pine-tree lost her dainty shoe.

No workmanship of mortal can compare
With what's exhibited in beauty there,
And looking at the treasure 'neath the tree,
The goddess' self I almost hope to see.

The tints of purple and the texture fine,
The curves of beauty shown in every line,
With fringes exquisite of golden hue,
Perfect the wonders of the fairy shoe.

The goddess surely must have been in haste,
Like Daphne fleeing when Apollo chased,
And leaving here her slipper by the way,
Intends to find it on another day.

And will she come to seek it here or no?
The day is lengthening but I cannot go,
Until I see her bring the absent mate
Of this rare beauty, though the time is late.

I watch, but still no classic form I see,
Naught but the slipper 'neath the forest tree;
And so, for fear of some purloining elf,
The precious relic I secure myself.

ZOOLOGY.

New Birds in Southern Illinois.— In the summer of 1871 the following species were noticed, and two of them obtained, by the writer, in Richland and Wabash Counties, in the south-eastern portion of Illinois, about latitude 38°, 25′: — *Vireo Bellii*, *Peucœa œstivalis*, *Cyanospiza ciris*, *Asturina plagiata* and *Falco Mexicanus*. The *Vireo Bellii* was found to be a common, or at least not rare, species in the thickets on the prairies. It was first seen on the 8th of June, when specimens were shot, and being then in full song, there can be little doubt that the species breeds there. The *Peucœa œstivalis*— a bird heretofore found only in South Carolina, Georgia, Florida, etc. — was found to be a common species in Wabash County, in old fields bordering on road-sides. As specimens of both old and young were obtained (on the 11th and 14th of August), and the former being in full song throughout the summer, there can be no doubt that the species breeds there. *Cyanospiza ciris* was seen only once — on the 10th of June — when it was observed in Wabash County, in an open thicket in the corner of an old weedy field. As the locality was not visited again, it is possible that the species may have been nesting there. *Asturina plagiata* was seen, and twice shot at, on the 19th of August, 1871, on Fox prairie, in Richland Co. I came across it while hunting Swallow-tailed and Mississippi kites (*Nauclerus forficatus* and *Ictinia Mississippiensis*), and while being annoyed by several of the latter, was well seen — it being immediately overhead — and shot at; it was afterwards followed a long distance among the trees which grew in a ravine intersecting the prairie, but finally lost. There can not be the slightest doubt as to the proper identification of the species, which I have been well acquainted with for years, and one which

could not be mistaken upon such close observation of it as that allowed for the individual in question. *Falco Mexicanus* (=*polyagrus* Cassin) was seen near Mt. Carmel, on the 27th of September, and near Bridgeport in July, 1871. This species has been observed, and also obtained, once before in Illinois, but in the northwestern portion, at Rock Island, by Mr. J. D. Sargent. The others are all new to the fauna of the state.—ROBERT RIDGWAY.

THE ANÆSTHETIC SCHOOL.—Prof. Cope remarked at the meeting of the Philadelphia Academy on May 21, that there were, and had been for years, two schools of naturalists, whose modes of treating Natural History subjects were quite different. In reference to these modes they might be called the *technical* and *natural* schools. As, however, the claim of the latter to better appreciation of natural affinities and classification, appeared to him to be doubtful, he thought they had better be called the *pseudo-natural* school, while the so-called technical naturalists were such, on account of their pursuing an analytic method. The pseudo-natural school decided on the affinities of organic types by their "physiognomy" or their *facies*, *habit* and "toute ensemble," reading nature with an artist's eye, and attaining opinions of systems, without the trouble of much anatomical study. They protested against the strict adhesion to "technical" (or structural) characters, saying that they violate "natural affinities" oftener than they support or express them. Thus their systems become physiognomical, and please the eye by their appearance, rather than the mind by their expression of exact structural relations. In accordance with this system, species were always well distinguished and could not have been derived from common parents, but that nevertheless everything "runs together," and that the higher groupings are mainly "opinionative." In fact, that although nature has a beautiful system we do not yet understand it, and that it is "too soon to generalize." Perhaps this obscurity has its advantages, as it certainly shelters in its profundities any theory of creation its supporters may choose to adopt. Hence they might be called the *Anæsthetic* school, or *anæsthesiasts* (or αἴσθησις). The *unnatural* school think that the way of determining the origin and relations of an object is to ascertain of what it is composed. This was to be accomplished by analysis of all its appearances and an account taken of every character. In this way the

structure is learned and a system based on anatomy is established. As anatomical systems are unnatural, and anatomical characters very difficult to discover by the anæsthesiasts, they regard such systems with disfavor, although they may constitute the only correct classification of bones, teeth, brains, etc. The analysts even find that species having very close specific relationships occasionally present different generic characters. This was proof positive to the anæsthesiast of the errors of the technical school. But it was still less to their credit that they laid stress on variations and monstrosities, which were mere accidents. The fact that the analyzers believed in the development of species, showed their systems to be unnatural. The speaker did not take sides, but observed that in order to learn the relations of a species, he usually examined it first.

MICROLEPIDOPTERA. — I have read with much interest Lord Walsingham's paper in the May number of the NATURALIST; and as I have given a good deal of attention to the *Tineina* and have received several letters recently as to collecting them, I wish to add a short note to Lord Walsingham's paper.

When one is at home or at a stationary camp, infinitely the best plan is to rear them from the larvæ and this is especially true of the leaf mining species. With such species as leave the mine to pupate, it is best to have a little moistened sand at the bottom of the wide mouthed bottle used as a breeding cage.

I have never found that the muscles were rendered rigid by the use of chloroform for killing the insect, as suggested by Lord Walsingham, but I have found that the positions of the wings and palpi are so variable when the insect is killed by chloroform that they can not be safely used as generic characters.

As the slighest denudation frequently renders the identification of minute species impossible, and it is exceedingly difficult to set them without some slight denudation, I do not attempt to set the smaller species (*Lithocolletidæ*, *Nepticula*, etc.). For such species I use the ordinary "deep cell" of a microscopic slide (small and shallow pill boxes will answer as well) laying a small piece of cotton or cotton wool on the bottom and covering the pill box with its top, or the cell with the ordinary glass cover held down by a small gum-elastic band. For observation under the lens I hold them in a small forceps by the legs.

For long collecting trips extensive preparations such as are described by Lord Walsingham are necessary. But for a morning's work about home it will be found convenient to take a wide-mouthed one ounce vial, a vial of chloroform, and a small paper box, say two inches square by one-half of an inch deep, with a piece of cottonbatting fitting into the bottom and another into the top of it. Loosen the stopper of the wide-mouthed vial, and put one or two drops of chloroform on it so that the fumes will fill the vial and then tighten the stopper again. When you find the micro-lepidopteron resting upon a fence, or the trunk or leaf of a tree, remove the stopper and invert the vial over the insect; it will spring back into the vial and in a moment will be quiescent; it may then be removed to the paper box (between the two pieces of batting, which will hold it steady and prevent it from getting rubbed). A drop or two of chloroform in the box will complete the work. The box may be carried safely in the vest pocket and the insects set upon return home.

Lord Walsingham says nothing about collecting from fences, etc., and recommends the late hours of the day as best for net-collecting. But for collecting with the vial as above described I have found the later morning hours, say from ten to one o'clock, the best and the trunks and fences the best localities. Out of at least one hundred and fifty species of *Tineina* which I have found here, fully three-fourths have been taken resting upon the leeward side of a board fence not two hundred yards long, at Linden Grove Cemetery at this place.—V. T. Chambers, *Covington, Ky.*

On the Occurrence of a Near Relative of Ægiothus flavirostris, at Waltham, Massachusetts.—Mr. Wm. Brewster, of Cambridge, Mass., some time since transmitted to the Smithsonian Institution, a specimen of a species of Ægiothus which heretofore has not been noticed as occurring on this continent. It was obtained Nov. 1st, 1870, from a flock of the common *Æ. linarius*, of which six specimens were also killed at the same shot. The specimen in question agrees most closely with females of *Æ. flavirostris*, a European species; but differs in some very essential respects, the most important of which is a tinge of sulphur-yellow in some places instead o' tawny buff, which reminds one, at first sight, of the *Chrysomitris pinus;* the tail is also shorter than in *Æ. flavirostris* proper. From the two common North American

species (*Æ. linarius,* =*fuscescens, rostratus* and *Holböllii;* and *Æ. exilipes,* = *Æ. canescens,* of which this is the smaller southern race) it differs in lacking the red pileum, and in the total absence of the dusky gular spot; besides in many other minor respects. The adult male of true *Æ. flavirostris* has the rump rosy, but has no crimson on the crown; and has the primaries and rectrices conspicuously edged with white. In view of the total differences from *Æ. linarius* and *exilipes* — in all the numerous stages of plumage — and taking into account its close resemblance to the female of *Æ. flavirostris,* it seems reasonable to place this specimen near that species; while at the same time, the features in which it does not correspond with the latter are sufficiently important to warrant our characterizing it as a different race which, perhaps, represents the true *flavirostris* on our Continent; we accordingly name it *Ægiothus* (*flavirostris* var.) *Brewsterii;* under which name it is noticed in Professor Baird's new work on North American Birds, now in press.—Robert Ridgway.

A Spike-horn Muledeer.— Prof. Cope, at a meeting of the Academy of Natural Sciences, May 21, called attention to the anterior curvature of the axis of the horn in the common deer, *Cariacus Virginianus*, and said it was a point of interest to determine whether the true axis or beam, was curved forwards or not. On comparison with the *Cariacus macrotis* of the Plains, it was found that the true beam was partly erect and was branched (as already shown by Baird), while an anterior snag was directed forwards, marking exactly the curved line of the axis of the *C. Virginianus*. The curvature of the latter was then shown to be due to the predominant development of this large anterior snag, and the partial suppression of the true beam. He then exhibited a spike, or second year's horn of the *C. Virginianus*, and alluded to the occasional occurrence of permanent spike-horned deer in the Adirondack region of New York. He said Alexander B. Lamberton, a gentleman who had spent much time in that region, confirmed the statements that had been made as to their existence, but said that they were rare. He then exhibited a pair of simple beams, or spikes, of two feet and a half in length, which had been taken from a black-tailed deer (*C. macrotis*), shot within three miles of the Kansas Pacific Railroad, in Kansas. They had evidently belonged to an adult animal, and were the first examples

of spike-horned deer of that species which had been recorded. It was obtained by Dr. J. H. Janeway.

Economical Entomology.—The plant lice affecting the vines to such a fearful extent in France, and which in this country have already done considerable damage, is still attracting much attention. The French Academy, as we learn from the "Revue Scientifique," has offered a prize of twenty thousand francs to encourage studies to ascertain a remedy which shall protect the vine without destroying it. The best remedy against the *Phylloxera*, as it is called, is the use of phenic acid, a substance much like carbolic acid. The French Government has always been alert and liberal in this matter of practical entomology, a subject more important to agriculture than dreamed of in this country, where it is estimated that we lose hundreds of millions of dollars annually from the attacks of injurious insects, etc. Two states in the Union—Illinois and Missouri have salaried officers, who, with a good knowledge of entomology, do much by spreading facts about noxious and beneficial insects among the people. But the leading agriculturists of other states practically, with one or two exceptions, ignore the matter. During the past summer the losses of wheat, corn, and other crops in the Western States have been enormous. The farmers in one county in Massachusetts have lost at least fifteen thousand dollars' worth of onions, their most valuable crop, next to hay, from the attacks of a minute insect, called Thrips. This annual loss, much of which could be now prevented, will accumulate in intensity, and be most grievous a century hence, when our country will become more densely populated and every grain of food will be needed.

The foresight of the French people, despite the present gloomy views of the "Revue Scientifique" and "France Scientifique" over the decadence of science among them, is conspicuous in their prompt and scientific treatment of the silk worm disease. Pasteur and Quatrefages, and others whose names are illustrious as investigators, have been commissioned to study the causes of this disease; and it is now thought, following out the suggestion of Pasteur — the result of profound studies on this subject — that if healthy eggs be selected and those infested with the parasitic fungus be destroyed, silk culture will be again restored in France and Southern Europe. A single silk-raiser, whose worms this year

will produce thirty-two thousand ounces of eggs, hopes next year to have a hundred thousand ounces, and the prospect of a profit of a million dollars! It should be remembered that this remarkable result is due primarily to the most minute researches upon microscopic plants by specialists, for the pure love of science. Their cloister studies, put to practical account, save the destruction of one of the largest agricultural interests in Southern Europe. In like manner had the government or individual states of America encouraged the entomologist and botanist in their studies, and caused them to be turned to practical account, we should not have had to give up the cultivation of wheat in the northernmost states, and our cotton crop could have been perhaps doubled, to say nothing of fruits and vegetables. Increased attention is paid now in England to economical zoology and botany. A botanist has recently been appointed to the Royal Agricultural Society, and an entomologist will soon be elected.

On the Occurrence of *Setophaga picta* in Arizona.—Lieut. Charles Bendire, U. S. A., stationed near Tucson, has communicated to Professor Baird the capture of the above-named species near that post. It was shot April 4th, 1872, and was found "running around the larger limbs of cottonwoods in search of larvæ and insects." Its manners are stated to be "considerably like the Certhiadæ."—Robert Ridgway.

Zoological Nomenclature.—"In the President's Address to the Entomological Society of London recently given by Mr. Wallace, one of the points most fully discussed is the rules of zoological nomenclature. These rules are undoubtedly of very considerable, though indirect, importance to science and it is not very satisfactory to find that great divergence of opinion as to what these rules are, or should be, still prevails amongst recent describers and cataloguers.

Some years ago I was entrusted by the Entomological Society with the task of preparing a synonymical catalogue of the Coleoptera of our islands, to be published under the auspices of the Society; my attention, therefore, has necessarily been directed to the questions under discussion in this matter, and I will here state the conclusions to which I have come.

1st. That a committee to frame and publish laws on zoological nomenclature is not to be desired. Such committee would have

no power whatever to enforce the laws it might make, and could not be expected to put an end to discussion on these points. The knot must be untied, not cut.

2nd. That the binomial system of nomenclature should not be arbitrarily considered to have commenced at any given date; but that recognisable names in all works in which this system is methodically employed should be used according to the rule of priority.

3rd. That it is not necessary to suppress a generic name in zoology because it has been previously used in botany (or *vice versâ*); but that it is much to be regretted that any generic name should thus be in double use, and it should always be made a matter of reproach to an author that he has committed an act of this nature.

4th. That names must be Latin to the extent that renders them capable of being written or used in scientific Latin; but that classical emendations beyond this are entirely inadmissible; no line except this can be drawn between emendation, alteration, and total suppression. The laws of classical languages have *per se*, no more right over scientific nomenclature than has the Hindoo language. As regards the much talked-of 'Amphionycha knownothing,' it should be latinised in the simplest manner, as *Amphionycha knownothinga;* and I would further suggest that its barbarian author be well hissed whenever he ventures to show his face in a scientific assembly.

5th. That as regards placing an author's name after a species, the name so placed should always be that of the first describer of the species, not because he has any right in the matter, but as an additional means of certainty, and as a security against change.

6th. That the specific name is the name of an object, and therefore a noun, and should be changed in gender, or any other manner, when removed from one genus to another.

7th. That it is very undesirable to use the same specific name in two closely-allied genera; but that where this has been done already no alteration should be made till the names actually come into collision on account of the two genera being united as one genus. Surely to act otherwise is like cutting one's throat for fear somebody else should do it.

8th. That as regards placing an author's name after a genus, the name so placed should be that of the author who established the genus in the sense in which it is actually used. *Carabus* of

Linnæus included all the insects now comprised in the family *Carabidæ*, at present divided into several hundreds of genera. To write, therefore, *Carabus* Linn., when we mean something entirely different, may be usual but is not desirable.

I may add, that I consider it useless to expect a perfectly stable zoological nomenclature, until zoology itself is complete and perfect; but that in order to reduce changes to a minimum, classical and other secondary claims must not be allowed any great importance."— D. Sharp, *in Nature.*

GEOLOGY.

A New Genus of Ungulates.—At a meeting of the American Philosophical Society, April 2nd, Prof. Cope stated that the largest mammal of the Eocene formations adjoining those of Wyoming, *i. e.*, of the Wahsatch group of Hayden, was the *Bathmodon radians* Cope, of about the size of Rhinocerus. It was an odd toed ungulate, with peculiar dental characters. The incisors were well developed above and below, as in the tapir, but the dental series was little interrupted. The crowns of the molars were all wider than long, and presented mixed characters. On the outer margin one only of the two usual crescents of Ruminants was present, but a tubercle represented the anterior one. The one which was present was very obliquely directed inwards. Inner crescents were represented by two angles, the posterior forming the inner angular margin of a flat table, the anterior a mere cingulum at its anterior base. The arrangement of these parts was stated to be of interest in connection with the relationships between the types of hoofed animals. The single outer crescent was a ruminant indication, while the inner table resembled the interior part of the crown of Titanotherium. It differed, however, in its early union with the outer margin, its edge being thus possibly homologous with the posterior transverse crest in *Rhinocerus*. The premolars had two or three lobes with crescentic section arranged transversely. He regarded the genus as allied to *Chalicotherium*. He stated that the mammalian fauna of Wyoming and Utah more nearly resembled that of the Paris Basin than any yet discovered in our country, and that it contained a still greater number of generalized mammalian forms. One of the most marked of these was the genus *Anchippodus* of Dr. Leidy.

Bowlders in Coal.—In the May number of the Naturalist (page 291), is an extract from the "Report of the Ohio Geological Survey," in which Prof. Andrews describes the occurrence of a quartzite bowlder in the coal of Ohio. This bowlder, he thinks, must have been transported there by ice; and to account for the ice he supposes a much colder climate for the coal period than most geologists would be willing to admit. It seems to me that a much simpler explanation, which dispenses with the supposed cold climate, is quite sufficient to account for the facts. It is well known that, during freshets, trees on the banks of streams are often undermined, and floated away, bearing in their roots large stones, which may thus be carried to great distances. In this way the small bowlder found in the coal of Ohio might easily have been transported. Similar instances of bowlders in seams of coal have been observed in this country and in Europe.—O. C. Marsh.

Food of Plesiosaurus.—At a meeting of the Academy of Natural Sciences, May 28th, Prof. Cope exhibited some vertebræ of a Plesiosauroid reptile and those of a smaller species, probably a *Clidastes* which were found in close proximity near Sheridan, Kansas, by Joseph Savage of Lawrence. According to this gentleman the vertebrate column of the *Clidastes* was found immediately below that of the Plesiosauroid and in a reversed position, as though it had been swallowed by the latter or larger reptile. The largest vertebræ of the *Clidastes* were about three-quarters the length and one-fourth the diameter of those of the Plesiosauroid, and the animal must have furnished a large or, at least, a long mouthful for its captor. The bones of the *Clidastes* were not in good condition, but resembled those of *C. cineriarum* Cope, though smaller. The Plesiosauroid was a species of over thirty feet in length and was the third species found in Kansas. It was new and was named *Plesiosaurus gulo*.

MICROSCOPY.

A New Erecting Prism.—Mr. Joseph Zentmayer exhibited, at a meeting of the Franklin Institute, a single prism which erects the image completely and in such a way that the incident and emerging rays are parallel, which, as far as we know, was never accomplished before. In connection with the microscope, as it was shown, it interfered very little with the definition, and, although

the light is twice refracted and reflected, the loss of light is much less than one would expect. With the microscope, the prism is placed right above the objective, and the instrument may be used

in any inclined position. A pair of such prisms might be used also for an erecting binocular microscope, of which the two bodies have the same inclination to the stage.

Fig. 1 shows the front and profile of the prism. The projection of the front is a square, that of the profile an isosceles triangle. The angles at the base of the triangle are 27°19 for crown glass of a refracting index of 1.53, in order to obtain the greatest aperture combined with the smallest prism.

Fig. 2 is a view from above. The rays A, B and C of figs. 1 and 2 are the identical ones, their dotted parts are the projections of the rays inside of the glass, and their course may be readily followed in the profile, fig. 1, where the upper ray, A, emerges as the lower one, and the lower ray, C, as the upper one.

As the ray A enters in the perpendicular line above the lower

edge, it will not be reflected out of its plane, while the rays B and C, entering the left side of the prism, reach the inclined faces, from which they are reflected to the opposite lower one, and are changed in their course to the right, from here again reflected, to emerge at the corresponding opposite point. Fig. 3 is a perspective representation of the prism. — *Journal of the Franklin Institute.**

Stephenson's Binocular.—Mr. Stephenson has reported to the Royal Microscopical Society, some improvements in his erecting binocular microscope. The lower prisms by which the light is divided and the image laterally inverted, are made smaller than before and placed nearer to the back combination of the objective. They are now made .68 in. long, .412 in. wide, and .2 in. thick; and are inclined to each other at an angle of 4¾°, making the angular divergence of the bodies 9½°, and the distance of the point towards which the eyes converge nearly fifteen inches. The prisms of this size are mounted in a small tube which projects beyond the nozzle of the instrument, and into the mounting of the objective nearly to the posterior combination of glasses. The quantity of glass in the prisms is greatly reduced, and powers as high as ⅛ in. may be easily used. The standard length of body is secured: and also an easy convergence of the eyes.

By altering the angle of inclination of the bodies to the perpendicular from 75° to 66½° the use of a Nicol's prism as an analyzer, which is quite unsatisfactory in a binocular, is easily dispensed with. When polarized light is used the box containing the upper prisms (the original upper prism being now made in two parts) is withdrawn and an analyzing plate of highly-polished glass substituted, reflecting the light at the polarizing angle of 56¾°, and securing more light and improved definition.

If desired, the upper prisms may be likewise replaced by a plane mirror silvered by the beautiful process employed by Mr. Browning in the manufacture of his reflecting astronomical telescopes. Thus we get rid of all the glass and of two surfaces, but obtain an incomplete reflection and a less permanent reflector.

Opaque Illumination under High powers.—H. A. Johnson, M.D., President of the State Microscopical Society of Ill., communicated to that society another method of producing this difficult effect. He employs Prof. H. L. Smith's plan of making

* We are indebted to the *Journal* for the use of the above cuts.

the objective its own illuminator; but instead of the silvered reflector, thin glass disc, or reflecting prism, used by Prof. Smith and subsequent experimenters, he employs the binocular prism of Wenham's binocular. A beam of light reflected down the oblique body of the Wenham binocular, the prism being in position as for ordinary use, is of course condensed by half the objective upon the object in its focus; while the other half of the objective and direct body of the instrument is used at the same time as a monocular for viewing the object. A portion of the field is intensely illuminated, and definition is said to be better than with other arrangements.

Collins' Light Corrector.—Mr. Collins, of London, has introduced a modification of Rainey's Light Modifier, to correct the glare of too intense light or the yellowness of gas-light, lamp-light, etc. A thin plate contains a rotating wheel with four apertures one of which is empty while the others present in turn a ground glass and two shades of blue glass. This contrivance, an illustration of which may be seen in the advertisements in "Science Gossip," is always ready for use, being simply laid, under the object, upon the stage of any microscope; though for use with an achromatic condenser it is somewhat better to have the correcting plate, whether of ground or blue glass, below the condenser. The new form of Light Corrector may be obtained of Miller Bros. whose address is given elsewhere in this number of the Naturalist.

Measurement of Angular Aperture.— For those students whose stands have not a graduated rotating base, Prof. T. D. Biscoe recommends a plan especially applicable to the larger form of achromatic condensers which cannot be as conveniently arranged for the method advised by Dr. Carpenter. He places the combination horizontally, with a gas flame several feet distant behind it to furnish nearly parallel light, holds a card across the centre of the front lens so as to bisect the cone of light, and with a fine pencil marks the edges of the illuminated portion of the card. A common protractor is used to measure the angle of the lines thus drawn. Though chiefly useful to measure the eye-piece form of achromatic condensers (Webster's condenser, etc.) as actually used with diaphragm, etc., in position, the method may be sometimes convenient for objectives of low power. Prof. Biscoe believes it can be applied to objectives as high as $\frac{1}{4}$ in. of 110° and be reliable within one or two degrees.

Organisms in Chicago Hydrant Water.—The "Lens" publishes an interesting note on the subject by H. H. Babcock of Chicago. While the Chicago river flowed into Lake Michigan, pouring into it a slow current of almost stagnant water saturated with organic matter, the hydrant water used in the city, taken from the lake at a point two miles from the shore and where the water is forty feet deep, contained an abundance, though a greatly varying quantity, of organisms, such as diatoms, etc. When the current in the river was reversed, so as to flow from the lake, the vegetable and animal forms mostly disappeared from the hydrant water; and the improved sanitary condition of the city, generally attributed to the absence of the former noxious effluvia from the river, may be due in part at least to the increased purity of the drinking water from the lake. The writer at first suspected that the water of the river had previously directly contributed the organisms found in the water from the "crib," but afterward was led to conclude that the change in the direction of the river only acted by changing the direction of the currents from other sources in the lake, thereby leaving the crib in purer water than before. Much more investigation of this kind ought to be immediately accomplished in view of the growing tendency, if not the imminent necessity, of supplying to our cities water from lakes and large rivers.

Record of New Fungi.—E. C. Howe of New Baltimore, N. Y., has recently discovered and described several new species of Fungi as follows:—*Uncinula luculenta*, *U. Americana*, *Microsphæra sparsa*, *M. finitima*, *Pestalozzia Zabriskiei*, *P. insidens*, and *Phragmidium fallax*.

Podura Scales. — American microscopists experience great difficulty in obtaining a satisfactory supply of these objects. The English Journals are agitating the same subject, and there seems to be some mystery as to the source of the familiar "test" scales. Mr. McIntyre suggests, not confidently, that they may be developed upon the common *Lepidocyrtus curvicollis* late in life. Mr. Joseph Beck states that no amount of age will develop them upon the common form of this insect, though they belong to an insect entomologically identical with it but having a different habitat: while E. G., of Matlock, recollecting that the late R. Beck told him that he found the Podura in the rockwork in his mother's garden, hunted for them in a cellar and found a lead-colored species which yielded scales equal to Mr. Beck's. He admits, however,

that only one slide in twenty, perhaps one scale in five thousand, was of any use. In his slide prepared by Mr. R. Beck there are only two well marked scales, which appear to be the exception and not the rule. Dr. Josiah Curtis, of Knoxville, Tenn., has been successful in collecting species of Lepisma, "Podura," etc.

THE STUDY OF "DIFFICULT" DIATOMS.—Mr. J. Edwards Smith of Ashtabula, Ohio, writes the following note which is suggestive of the experience of many microscopists who study the finer diatoms without making a specialty of them.

"I find that Pritchard describes *Navicula cuspidata* as having close *transverse* striæ. I have slides of this diatom, mounted dry and in balsam, and with my Tolles' $\frac{1}{8}$ dry, or $\frac{1}{10}$ wet, have no difficulty in showing longitudinal striæ, far finer than the transverse; indeed when mounted dry both sets can be plainly seen at once. Is there anything remarkable about this?

I notice that Möller places *Navicula crassenervis* as the 18th on his 'Probe Platte'. I fail to discover striæ on this diatom either in balsam or mounted dry. Pritchard says they are sometimes wanting. The objectives above named show the fine lines in No. 17 (*Cymatopleur œlliptica*) very nicely, but fail on Nos. 18, 19 and 20. Our friends here are interested to know what others are doing with this 'Probe Platte.' Has Amphipleura pellucida been resolved in balsam? When, by whom, and with what lenses?"

ANS.—Nothing can be more certain than the uncertainty of what has been known, in regard to the markings and structure of diatoms. It would be rash at present to pronounce any shell free from markings, and would probably be repeating a mistake too often made already. Different shells of the same species vary greatly in "difficulty," but no explanation or excuse is necessary for a dry $\frac{1}{8}$ failing to go entirely through the series on the test-plate. It is by no means easy, though sometimes possible, to resolve *A. pellucida* in balsam with dry lenses and ordinary illumination. With immersion lenses, however, and monochromatic illumination, there is no difficulty in accomplishing this with objectives of Tolles, Wales, Powell and Lealand, Beck, Hartnack, and Nachet, and doubtless several other makers. About two years ago Count F. Castracane resolved and photographed *A. pellucida* in balsam, with French lenses and monochromatic sunlight. For a method by which this can be easily accomplished see Dr. Woodward's paper in the NATURALIST for April last.

NOTES.

AGAIN has science been called upon to give up one of her brightest lights and most enthusiastic devotees, and many of our readers have in the death of Dr. WILLIAM STIMPSON to mourn for a dear friend. Dr. Stimpson was born in Cambridge, Mass., and early became devoted to Natural History pursuits. He also had the good fortune of being under the guidance of Agassiz and soon became an original investigator and distinguished as a malacologist. His first publication was on the marine shells of New England, in 1851. From this time he pursued the study of Marine Zoology with the greatest vigor, and dredged and collected along our Atlantic Coast from Florida to Grand Menan, until he became the authority in the lower forms of animal life, especially in the classes of Crustacea, and Mollusca, and until Mr. Verrill commenced his work on our Radiates, Dr. Stimpson was the acknowledged authority in that group also. In the classes of Mollusca and Crustacea of our Atlantic coast, Dr. Stimpson was to the time of his death the acknowledged head of the able band of workers in these departments, while his connection with the Government Exploring Expedition to the North Pacific, as naturalist, gave him a wide field of work in his most favorite study of the Crustacea, in which he shared equally with Dana the honors of the scientific world. As a dredger Dr. Stimpson early became noted, and taking his first lessons in our own harbor of Salem, under the guidance of Dr. Wheatland, he soon became the pioneer in this science along our whole coast, and his very last work was the superintendence of the deep sea dredging off the coast of Florida under the direction of the Coast Survey. Dr. Stimpson's connection with the Chicago Academy of Science, as the successor of the lamented Kennicott, is known to all, and to the disastrous fire, which in one short hour destroyed all his material, manuscripts, drawings, specimens and library, must we attribute the close of his life at the age of forty-two years. For though suffering from lung disease, there is little doubt but that for the fearful calamity which so suddenly destroyed all his work and hopes, he would have lived to have seen published the valuable works, which, owing to a fatal delay on the part of government, are now irrevocably gone;

though the many descriptions and preliminary papers which he published, and his early works, will forever connect his name with the marine zoology of the world.

The Committee to arrange for the next meeting of the Association for the Advancement of Science have informed us, just as we go to press, that the meeting *will not* be held in San Francisco as previously announced, but in **Dubuque, beginning on Wednesday morning, August 21st, at 10 o'clock.** We shall give all the details possible in our August number, and the circulars to members will undoubtedly now be issued at once by the Local Committee.

It will be noticed that the Herbarium of the late Rev. M. A. Curtiss of Hillsboro, N. C., the veteran and highly esteemed Mycologist, is offered for sale in our advertising pages. But a few months ago we were in correspondence with Dr. Curtiss, relative to the publication of his manuscripts and drawings on the edible fungi of the United States, and though aware of his feeble health we had no reason to suppose his life labors were so nearly over; the first intimation we received being the request to publish the advertisement given in this number. Dr. Curtiss has so long been identified with the study of the important and interesting group of Fungi, and has so extensively exchanged and collected specimens, that his collection must be of the highest value as an authentic one in this most difficult department, and we trust that it will at once be secured for some prominent herbarium where his life-long labors will be appreciated and made useful.

"It is with very great regret that we have to record the death of Mr. George Robert Gray, which took place on the 6th of May, after a short illness. He was born in the year 1808, at Little Chelsea, and was appointed an Assistant in the Zoological Department of the British Museum in 1831. At the time of his death, he occupied the post of Assistant Keeper of that department. He established his reputation as an ornithologist by his "Genera of Birds," a great work, in the production of which he was engaged for twelve years, from 1837 to 1849. From that time he was *facile princeps* in this branch of science, to which he devoted himself almost exclusively. Only a short time before his death he completed his invaluable "Handlist of Birds," published in three volumes by the Trustees of the British Museum." — *Academy*.

THE Boston Society of Natural History have very wisely decided to offer the *Annual Walker Prize for* 1873 for a memoir "On the development and transformations of the Common House Fly," thus not only carrying out the liberal bequest of Dr. Walker, in offering pecuniary assistance to worthy investigators, but at the same time calling attention to how little is known of the early life-history of one of the most abundant of insect pests. Trusting that the prize may induce several of our entomologists to turn their attention, for this year at least, to the much neglected group of Diptera we refer to the advertisement for particulars.

ANSWERS TO CORRESPONDENTS.

E. M.—The Diatom of your figure and description may possibly be *Triceratium spinosum* B., which has been obtained from Florida, and which varies so greatly that it has been described under several different names. We should like to have specimens for further examination.—R. H. W.

T. W.—The "Society Screw," to which are fitted all American and a large proportion of European objectives, is practically indispensable to a satisfactory microscope at the present day; yet it should not be considered by any means indispensable in buying a microscope. It can be added, by means of an adapter costing about one dollar, to any microscope large enough to work the modern objectives.—R. H. W.

H. H. Y.—Wants to know what causes the bursting and curling of the pod of Touch-me-not (*Impatiens*)? Strongly unequal tension: the outer and juicy part of the wall wants to expand, the inner to contract: a slight displacement, destroying the equilibrium of the pressure of the valves on each other, gives rise to the result. He also wants to know "what force governs the sensitive plant"? The movement is a vital one—as much so as the movement of our hand in writing. But the force that moves the leaf-stalks is, again, one of *tension*,—unequal tension upon different sides. How the unequal tension is brought about, if to be explained at all, cannot be explained in a word or two.

E. H., Jr. Amherst, Mass.—The capture of two specimens of the Cape May Warbler (*Dendræca tigrina*) in May of this year at Amherst, Mass., by Messrs. S. Dickinson and W. A. Stearns, Jr., is an interesting fact. It is properly regarded as a rare bird in this State, occurring sparingly and at irregular intervals. (See Amer. Nat., Vol. III. p. 578.)—J. A. A.

L. H. N.—(Finds Dr. Woodward's method of resolving *Amphipleura pellucida* to work splendidly.) Should you succeed in resolving the above diatom, in balsam, with any lenses of less than 1-8 in. equivalent focus, rated on the principle of 1 in. by 10, we should be glad to know the particulars, including the amplifying power and angular aperture *of the objective* both at open point and at the working point as used for the resolution. We should also be glad to know the amplifying power and working angle of your Powell and Lealand 1-16 as adjusted for the work so well done by it.—R. H. W.

L. F. A., Wilton, Maine.—Some grasshoppers hibernate in the perfect, some in the larva or pupa, and others in the egg state. The borer which you find far up in the trunk of your apple trees, is doubtless *Chrysobothris femorata* Fabr., popularly known as the Flat-headed Borer.—C. V. R.

C. N. S., Fayetteville, Pa.—The small borers which infested your young peach shoots while they were in blossom, judging from your description, and from a dried and flattened specimen received through Mr. S. S. Rathvon of Lancaster, were the larvæ of a small slate-colored moth—*Anartia lineatella* Zeller. We have bred it from peach-stem-boring larvæ, and it has similar habits in Europe, being common to both countries. The larva of *Gortyna nitela* Guen., a much larger moth, also bores into peach stems.—C. V. R.

J. L. L. Jr., Boston, Mass.—Your figure represents the Book-Scorpion or False-Scorpion (*Chelifer cancroides* Linn.). It runs sidewise and backwards as well as forwards; feeds on mites and book-lice (*Psoci*) and is consequently not injurious.—C. V. R.

C. W., WETHERSFIELD, CONN.—The two worms which you send are both larvæ of the Imported Currant-worm (*Nematus ventricosus* Klug). The spotted specimen not having yet undergone its last molt, while the immaculate specimen has. One of the peculiarities of this larvæ being that it loses, after the last molt, the black spots which characterize it in the earlier stages. If Mr. Packard in his first Report has not given the systematic name, it is probably an oversight. The ♂ was named *affinis* and the ♀ *trimaculatus* by St. Fargeau, who, of course, knew nothing of the insect's habits; and Dr. Fitch, by a singular oversight, subsequently adopted St. Fargeau's ♀ name.—C. V. R.

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Second Annual Report on the Noxious Insects of the State of Illinois. By William LeBaron. 8vo pamph. 1872. Springfield.

Annual Report of the Trustees of the Museum of Comparative Zoology at Harvard College, in Cambridge, together with the Report of the Director for 1871. 8vo pamph. Boston, 1872.

Fourth Annual Report on the Noxious, Beneficial and other Insects of the State of Missouri. By Charles V. Riley Illustrated. 8vo pamph. 1872. Jefferson City.

Bulletin of the Museum of Comparative Zoology. Vol. III. No. 4. Preliminary notice of a few species of Echini. By Alexander Agassiz. 8vo pamph. 1872.

Annual Report of the Board of Regents of the Smithsonian Institution for 1870. 8vo. pp. 494. Washington, 1871. [April, 1872.]

Spectrum Analysis Explained and Spectrum Analysis Discoveries. Forming Nos. 3 and 4 of Half-hour recreations in Popular Science. Edited by Dana Estes. 12mo. Boston. Lee and Shepard. 1872.

Societe Malacologique de Belgique. (Bulletins des Seances.) 8vo. pp. 25-40. 1872.

Second Annual Report on the Injurious and Beneficial Insects of Massachusetts made to the State Board of Agriculture. By A. S. Packard, Jr. 8vo. pamph. 1872. Boston.

Affinities of Paleozoic Tabulate Corals with existing Species. By A. E. Verrill. (From the Am. Jour. of Sci. and Arts. Vol. 3. March, 1872.)

Spiritualism answered by Science. By Edward W. Cox. New York. Henry L. Hinton. 1872.

Recent Additions to the Molluscan Fauna of New England. By A. E. Verrill. (From the Am. Jour. of Sci. and Art. Vol. III. March and April, 1872.) 8vo pamph. New Haven.

Progressive Bee Culture. Illustrated and Systematized. By Dr. L. Adair. 8vo pamph. 1872. Cincinnati.

Catalogue of the Birds of Kansas. Contributed to the Kansas Academy of Science. By Frank H. Snow. 8vo pamph. Topeka, Kansas. 1872.

Tidsskrift for Populære Fremstillinger af Naturvidenskaben. 8vo pamph. Fjerde Række: Fjerde Binds. Forste Hefte. Fjerde Binds andet Hefte. 1872. Kjobenhavn.

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Horæ Societatis Entomologicæ Rossicæ. 8vo. Tome vii. No. 4. Tome viii. No. 2. 1871. Petropoli.

La Production Animale et Vegetale. 8vo. 1867. Paris.

Bulletin Mensuel de la Societe d'Acclimation. 8vo. Tome viii. Nos. 1-12. 1871. Paris.

Bulletin de la Societe Imperiale des Naturalistes de Moscou. 8vo. Tome xliv. Nos. 1 et 2. 1871. Moscou.

Jahrbuch der kaiserlichen-koniglichen Geologischen Reichsanstalt. 8vo. Band xxi. Nos. 3 and 4. 1871. Wien.

Bulletins de l'Institut National Genevois. 8vo. Vol. xvi. No. 35. 1870. Geneve.

Bulletin de la Societe des Sciences Naturelles de Neuchatel. 8vo. Tome xvi. 1871. Neuchatel.

Pisciculture dans l'Amerique du Nord. (Extrait du Bulletin de la Societe d'Acclimation.) 8vo pamph. 1871.

Archiv fur Anthropologie. 4to. Funfter Band. 1871. Braunschweig.

Annales Academici. 1866-1867. 4to. 1871. Leiden.

Proceedings of the Royal Society. 8vo. Vol. xviii. Nos. 119-122. 1870. Vol. xix. Nos. 123-129. 1871. London.

Third and Fourth Annual Reports of the Flax Extension Association. 8vo pamphs. 1870, 1871. Belfast.

Instructions for the Culture and Preparation of Flax in Ireland. By Michael Andrews, Jr. 8vo pamph. 1870. Belfast.

The Physician's Annual for 1872. 12mo pamph. Philadelphia.

Lecture on Water, delivered before the American Institute of the City of New York. By C. F. Chandler. 8vo pamph. 1871. Albany.

Instinct in Animals and Men. By P. A. Chadbourne. 12mo. Cloth. New York. G. P. Putnam & Son. 1872.

First Annual Report of the Board of Commissioners of the Department of Public Parks, for the year ending May 1, 1871. 8vo. Illustrated (City Document). New York.

Annual Address before the American Geographical Society in New York. 8vo pamph. By Daniel C. Gilman. 1872. New York.

Fourth Biennial Report of the Board of Trustees of the Iowa State Agricultural College and Farm, to the Governor of Iowa. 8vo pamph. 1872. Des Moines.

Illustrated Catalogue of the Museum of Comparative Zoology, at Harvard College. No. iv. Deep Sea Corals by L. F. de Pourtales. 93 pages. 8 plates. No. v. The Immature State of the Odonata. Part I. Sub-family Gomphina by Louis Cabot; 17 pages. 3 plates. No. vi. Supplement to the Ophiuridæ and Astrophytidæ by Theodore Lyman. 17 pages. 2 plates. Large 8vo. 1871. Cambridge.

How Plants Behave: How they Move, Climb, Employ Insects to Work for them, etc. By Asa Gray. Forming Part 2 of Botany for Young People. 12mo, board, pp. 46. Illustrated. New York and Chicago: Ivison, Blakeman, Taylor & Co. 1872. (75 cts. Naturalists' Agency.)

Entomological Contributions, No. 2. By J. A. Linter. 8vo pamph, pp. 66. Albany. 1872.

On the Structure of the Skull and Limbs in Mosasauroid Reptiles, with Descriptions of New Genera and Species. By O. C. Marsh. 8vo pamph. pp. 21. 4 plates. June, 1872.

Early Stages of the American Lobster. By Sidney I. Smith 8vo. pp. 6. 1 plate. June, 1872.

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La Revue Scientifique. Series 2. Nos. 40—49. 1872. Paris.

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A NEW ENTOZOON FROM THE EEL.

BY REV. SAMUEL LOCKWOOD, PH.D.

IN the spring of 1869, while at work on the study of a question connected with the common eel, *Anguilla acutirostris*,* my attention was drawn to a small white speck embedded in a morsel of fat on the intestine of that animal. As said above, its color was white, while the fat of the fish is quite dark. It was this contrast that made it so easily observable, although it was of very minute size; for in its greatest length it was not much more than the one-twentieth of an inch; and its breadth at the forward end, which

* This name, *Anguilla acutirostris*, is one of the twenty and odd synonymes given to the common eel of Europe, first systematically referred to the genus under the name of *A. vulgaris*. Dr. Günther refers a specimen received from New Jersey and in the Liverpool Museum, to the same species as the European, but considers our common eel, which also has been described under many names, though best known under that of *A. Bostoniensis*, as distinct from *A. vulgaris* of Europe, although identical with specimens from China and Japan.

From extensive comparisons of specimens collected by the hundreds from the salt and fresh waters of Massachusetts, and from Lakes Champlain and Erie, with several from England and China, I have little hesitation in referring our *A. Bostoniensis* with all its marine and fluviatile uncles and aunts, grandfathers and grandmothers, back to its super great grandparents, to one and the same species with the common eel of Europe, uniting them all under the name of *Anguilla vulgaris*, or the *Muræna Anguilla* of Linnæus and the old writers. Either this must be done or almost every hundredth specimen collected must be regarded as the type of a distinct species, for a perfect series from long heads to short heads and long tails to short tails, thick lips to thin lips silvery color to black, etc., etc., can be made out of any large lot, and no set of character, can be selected as of specific value without finding them worthless for the purpose in almost the very next specimen taken in hand.—F. W. PUTNAM.

was the thickest part, was about one-eighth of the entire length. That it was an individual organism I had not the least suspicion. It was solely its white color, in such direct contrast with the dark adipose tissue, in which it was contained, that excited my curiosity. On this account it occurred to me that the microscope might reveal some difference in structure. Having put it under a lens of very moderate power, I was surprised to see a vermicular object, with the thick end truncated. Now a deep regret seized me; for I supposed that in the dissection of the eel, the most important part of this interesting specimen had been unwittingly cut off. The appearance thus presented in the microscope is shown in Fig. 120, where it looks like a worm with its anterior end excised. Thus regarding the object as ruined by an untoward accident, I was about to cast it aside, when lo! to my glad astonishment, the creature began a singular movement at the supposed decapitated end. Astonishment is not the word—it was in amazement that I gazed upon that strange movement. Such a sight could never be forgotten. Who does not remember the childlike delight at seeing for the first time a juggler draw the almost interminable cornucopia out of his mouth, until the mountebank's head looked like that of the fabled Unicorn? But that was only a smooth paper cone, after all; and the trick of it every schoolboy well understands. Not so with this feat of my puny capitve, at whom I had the lone privilege of gazing through this wonder-peering instrument. Like the sheriff, who was obliged on account of his pleasant bearing, to respect the unwelcome tenant whom he had just ejected; so I must confess that this unpleasant occupant whom I had ousted from its strange dwelling-place, had compelled my admiration, by a singular gracefulness of form and

Fig. 117.

Anterior portion of *Echinorhynchus gigas*, showing the projected proboscis, with rings of hooklets. (From Owen.)

Fig. 118.

Longitudinal section of *E. gigas*, showing proboscis retracted, the hooklets still external. *a*, the oral pore. *bb*, the protractile muscles. *cc*, the retractile muscles. (From Owen.)

movement, albeit certain outré and weird-like accomplishments. With a slow, steady and uniform movement, a beautiful and tiny structure rises up, until the truncated end is capped or surmounted. by a pretty little pagoda, with many circlets of hooks, the distance from ring to ring, being uniform. It was as if a miniature tower had risen out of a little crater, and covered it with its base. The whole structure is pellucid, l ke old milky-white china. So that now the end that seemed to be cut across is completed by having a cone projected on it as a base, the apex terminating almost in a point. At this extremity is a little pore, which probably serves whatever of oral function is needed, hence it may be called its mouth. Fig. 121. The evolving of that pretty cone was not only a beautiful sight to look at; but the method of its evolution was a grand thing to see into. As it rose slowly, it was a lengthening truncated cone, with a crater at the upper, or smaller end. And this cone, although without change at the base, kept steadily lengthening at its sides, and narrowing at the top, until at length the truncation, and the crater disappear together — the former in a rounded point, and the latter in a pore. Fig. 122. *a*, *b*, *c*, *d*.

Fig. 119.

Transverse section of *E. gigas*. *aa*, Lemnisci, attached to the sides of the neck by a thin appendage, and ending in a cul-de-sac, supposed to be nutrient processes. *bb*, cylindrical canals which adhere closely by the other side to the muscular fibre *cr*, triangular spaces, filled with parenchymatous matter. *f*, dorsal ovary sack, or testis. *g*, Ventral ovary sac, or testis. (From Owen.)

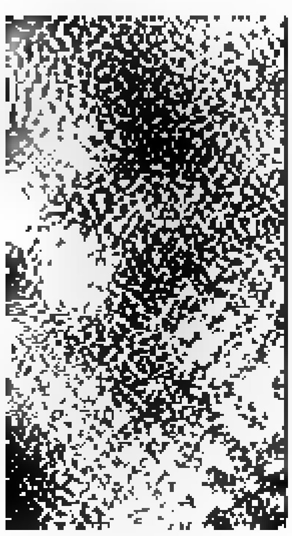
Fig. 120.

Koleops Anguilla in repose, the proboscis withdrawn giving the truncated appearance.

But how could this be done? It should be mentioned that a similar extensile organ in other entozoa has been called by naturalists, from sheer poverty of language, the "proboscis." Hence there is no help for it; and we must use the same inexpressive word. There is a species to which our specimen is allied, which is known by the name *Echinorhyncus gigas*. Its proboscis, w en protruded, is of a spherical form, with a neck, or stem below; while at the top of the sphere is a slight projection, around which are several rows, or rings of hooklets. In the centre of the ring that surrounds the top is the oral pore. Figs. 117 and 118, *a*. Without regarding form precisely, but rather looking to function, let us liken the neck of the animal to the hand of a glove, and the proboscis to one of its fingers. Suppose that finger to be with-

drawn, or inverted. There are two ways in which I can revert the same. I may wish to do so by starting the tip end of the finger, as if I should push it out by pressing the end of a wire upwards, against the under side of the tip, which would in this way come out first: or I could, if I wished, push the finger out at the sides. This could be done, for illustration, by having in the hand part of the glove a tube or cylinder of the proper size, down which the glove finger has been neatly pushed, so as to fit snugly against the inner sides of the cylinder. Now if the cylinder be gently pushed upward, the glove finger will ascend on the outside of the cylinder having, as it rises, a crater-like depression at the top. The first of these methods illustrates the propulsion of the proboscis of *Echinorhyncus gigas:* and the second one shows the actual evolution of the proboscis of our new entozoon. It is done by the pushing of abductor muscles on the sides of the everting and lengthening cone.

Fig. 121.



K. Anguilla, with proboscis projected, showing the rings of hooklets.

It is noticeable of our species, that when the proboscis is returned into the body, the hooklets are all turned inside the proboscis. Fig. 122, *e*. This is not true of Echinorhyncus, which keeps its hooklets external to the proboscis, whether that organ is extruded or withdrawn. Figs. 117, 118.

Three real, and easily appreciable distinctions are now pointed out in these two helminths. They differ greatly in the form of the proboscis; also in the method of propulsion of the same, a method requiring for each differently adjusted muscles; and they differ in the position of the hooklets, when the respective probosces are inverted. It is plain then that our specimen belongs to a new genus.

As to their ordinal relations; both are members of Owen's second Class of the Entozoa, embracing the Sterelmintha, or Solid worms; and both evidently belong to Duvaine's Type iv., Acanthocephala, or Spiny Heads; and to Rudolphi's Order iv., which bears the same name. Now in this order there is but one genus, namely, Echinorhyncus, already mentioned; therefore we put in the order a new genus, to which we give the name *Koleops*, meaning "sheathed-head" and species *Anguilla*, because found in the common eel.

But the systematist may claim a word. If our name is to be accepted, the giving must respect the methods which Science regards as Orthodox. Accordingly the following is offered as sufficiently technical to be precise; and yet perfectly appreciable by the popular judgment.

KOLEOPS ANGUILLA Lockwood (gen. et sp. nov.).

Description.—Solid. Form, vermicular, truncated at anterior end, when at rest; when in action the proboscis extended, making with body two cones united at their bases. Length, less than a line when at rest. Thickness at base about one-eighth of length. Proboscis encircled by rings of hooklets external to the cone and pointing backward, when the proboscis is retracted, the hooks are internal to the cone, and point forward. Color tallowy-white, pellucid. At extremity an oral pore.

Habitat.— In adipose tissue on the entrails of the common eel, *Anguilla acutirostris*. Specimen taken from an eel caught in Raritan Bay, near Keyport, N. J. Spring of 1869.

As to the use of those spiny circlets on the proboscis. While they can present but very little obstruction to the penetrating of that organ, the hold thus given the little parasite is very great; indeed it is certain that any attempt to dislodge it must fail, while these grapnels are buried in the tissue, and but for the peculiar muscular functions of the cone-like proboscis, its extraction must be fearfully lacerating, like the withdrawing of an arrow with many barbs. Certain it is that no human device could extract that tiara shaft of spiny rings, from the living tissue, without inflicting an agony beyond expression. When the butcher lifts the meat off his shamble hooks, he does it with a motion suited to the form of the hook, that he may not tear the meat. When Koleops would retract its thorny shaft, the process is begun at the extreme point, which of course is at the bottom of the wound; and how deftly, easily, yea, perhaps painlessly, this is done. Involution is begun at that extreme point. The end of the proboscis sinks downward within itself. In fact, it is not a withdrawing in the ordinary sense; for that would make the entire organism move at once, and every barb would tear. It is a gradual involving, beginning at the point, and of course, the first circlet of hooks is by this involving, everted from its hold, and inverted as respects the deepening crater of the now shortening truncated cone. Given the problem, economy of suffering, could a solution more admirable be afforded? It is to be observed that the instant the point of the proboscis reënters the neck on its return into the body, the

Fig 122.

K. Anguilla, *a*, *b*, *c*, *d*, showing the progressive projection of the proboscis. *e*, showing position of proboscis when withdrawn, with the hooklets inside of the cone.

part without, or external to the neck, is a frustrum of a cone, while the part now within, or below the neck, is a lengthening cone, until the external frustrum wholly disappears, and the internal cone is complete; and the animal is at rest.

But little beyond conjecture can be said on the mode of use of the oral pore. It may be a sucking organ, thus imbibing nourishment. To me it seems that the entire external walls of the proboscis are functional in this direction; and during the slow inversion of this instrument, that is, while withdrawing from its hold, as each ring of hooklets is released, and involved into the crater of the returning cone, the limpid adipose flows over the crater's edge; thus the cone when returned contains a supply of nutriment. I hardly know how heterodox the view may seem to some, yet the idea presses me that the osmotic doctrine of a chemical impulsion of the nutrient fluids and gases, plays an important role in the nutritive system of these curious beings.

But my pen must stop with a confession. I must own that during the study, whose results have been given above, the so called repulsiveness of the subject was both unseen and unfelt, in the reverent sense that came upon me; so that in studying this singular organism, so lowly and so minute, with a functional structure so complete and complex, with adaptations so skilfully adjusted to a mission so mysterious—I found myself, not without emotion, repeating the sublime words of Saint Augustine: Deus est magnus in magnis, maximus autem in minimis.

NOTE.—An oral account of my discovery, with some blackboard chalking, was given to the N. Y. Lyceum of Natural History, May 12, 1869. November 14, 1871, I read a paper, giving the results of my study, before the New Jersey Microscopical Society. From that paper the principal facts given above have been taken.—S. L.

ON THE USE OF MONOCHROMATIC SUNLIGHT, AS AN AID TO HIGH-POWER DEFINITION.*

BY DR. J. J. WOODWARD, U. S. ARMY.

A FEW years ago I published, in the "Quarterly Journal of Microscopical Science" (Vol. vii, 1867, p. 253), some brief remarks

* Read before the Philosophical Society of Washington, March 9, 1872.

"On Monochromatic Illumination." These remarks were suggested by the perusal of a letter from Count Francisco Castracane published in the same journal some time before. (Ibid. vol. .v, 1865, p. 249.)

Count Castracane's method consisted essentially in the use of a prism by which the sunlight was decomposed, and any selected color could be employed, blue or green seeming to him most advantageous. Mine consisted in passing the sunlight through a cell containing a saturated solution of the sulphate of copper in ammonia, which transmits a bluish violet light, admirably suited to high power definition and less fatiguing to the eye than any other color.

At the time I supposed Count Castracane's method to be new; the one I employed I ascribed to Von Baer ("Einleitung in die Höhere Optik" p. 48). I have since learned that I was in error in both particulars. The proposition to escape chromatic aberration by employing monochromatic illumination goes back in fact to a very remote period in the history of achromatic microscopes, and monochromatic lamps, as well as the use of the prism and of glasses and colored fluids as absorptive media, were early suggested. It would carry me away from my present purpose to go into a detailed history of the various attempts made from time to time in these directions. As the construction of achromatic objectives continued to improve, these devices fell into obscurity and it is only of late that attention has been directed to them anew. As for Count Castracane's method, without going further back, a full account of all the principles involved in the use of the prism for attaining monochromatic light to illuminate the microscope will be found in Chapter vii of the article on the microscope in the eighth edition of the "Encyclopædia Britannica" (American edition 1857, Boston, Vol. xiv, p. 798).

The use of the solution of the ammonio-sulphate of copper to exclude certain portions of the solar rays especially for photographic purposes, would appear to have been first suggested by one of our own countrymen more than thirty years ago.

Professor J. W. Draper published in the "Journal of the Franklin Institute" of Philadelphia, during the year 1837, a series of "Experiments on Solar Light" in the course of which several observations on the properties of the ammonio-sulphate of copper are recorded. In one of these papers (Loc. cit. Vol. xix, 1837, p.

473) he states that the ammonio-sulphate solution absorbs the red and yellow rays of the spectrum and with them so much of the heat that but "twenty rays, for every hundred that fell upon it," were transmitted.

In the London, Edinburgh, and Dublin Philosophical Magazine for September, 1840 (Vol. xvii, p. 217) the same gentleman published a paper "On the Process of Daguerreotype and its application to taking Portraits from the Life" in which he describes his attempts to reconcile the chemical and visual foci of portrait objectives, to escape "the effulgence" of the solar rays thrown directly on the sitter, as practised at that time, " abstract from them their heat and take away from them their offensive brilliancy." These are almost the very objects for which microscopists to-day resort to the copper solution. Professor Draper employed in his experiments "a large trough of plate glass, the interstice being an inch thick" filled with a dilute solution of the ammonio-sulphate. Its size was about three feet square. This was so fixed in the course of the sun's rays, reflected from a mirror upon the sitter, that his head and the adjacent parts were illuminated only by the light which had passed through the copper solution. By this device he reports he obtained excellent results.

In the spring of 1869 I received a letter from one of the sons of Professor Draper (dated April 19th) calling my attention to the above facts and transmitting several daguerreotypes of microscopic objects all bearing the marks of considerable age. These the writer (Prof. Henry Draper) states were made at various dates from 1851 to 1856. A Nachet microscope was used and in every case the ammonio-sulphate of copper is said to have been employed.

The results are not particularly good as compared with modern photomicrographs, but appear to me not much inferior to the best that could have been done by the daguerreotype method with the microscope used. The time was not yet ripe, and both microscopic objectives and photographic methods have vastly improved since those days.

My present purpose does not permit me to give greater space to these reminiscences, the real object of this paper being to indicate the best practical method to be pursued in obtaining economically the advantages of monochromatic sunlight for high power definition.

This object excludes a further consideration of the use of the

prism. It does its work admirably as I know by repeated trial, but the results are practically no better, even for photography, than those obtained by the use of the ammonio-sulphate cell, it requires greater skill to use, and the necessary apparatus is more expensive. For the same reason I shall say nothing in this article on the use of artificial lights, further than that both the prism and the ammonio-sulphate cell may be satisfactorily used with either the Calcium, the Magnesium or the Electric lights by those who are unable conveniently to secure the advantages of sunlight. The light of ordinary coal oil or gas lamps, however, is not suitable for the purpose.

Two very simple methods of securing the advantages of the ammonio-sulphate solution will now be briefly described.

(a.) I suppose the observer to be possessed of a good microscope stand, with achromatic condenser and suitable objectives. Then it is only necessary to prepare a proper ammonio-sulphate cell and fix it between the plane mirror of the instrument and the achromatic condenser. The microscope should be set near a window so that the direct rays of the sun fall on the plane mirror, while the head of the observer is protected by a convenient screen and all becomes easy.

(b.) A still better method for the resolution of lined test-objects with the highest powers, and one which is almost as simple as the foregoing is that described in my paper "On the use of Amphipleura pellucida as a test-object for high powers." (This Journal, April, 1872, p. 193.)

"Erect a perpendicular wooden screen about two feet square on one edge of a small table. Cut in this a circular hole an inch and a half in diameter at about the height of the under surface of the stage of the microscope. On the outside of this hole mount a small plane mirror which can be adjusted by passing the hand to the outside of the screen. On the inside cover the hole with the ammonio-sulphate cell." Now move the table to a window through which the direct rays of the sun can fall upon the mirror, and adjust this so as to throw the solar pencil nearly horizontally through the ammonio-sulphate cell. The mirror, and achromatic condenser, if the microscope has one, are removed and the microscope turned so that the solar pencil shall fall with the desired degree of obliquity on the under surface of the object. It will generally be best to condense the light upon the object by a small

ordinary lens, or still better by a low power objective mounted like a bull's-eye lens on a separate stand.

For prolonged observation, however, the motion of the sun will render it necessary to readjust the mirror from time to time, and the use of a heliostat becomes desirable. This gives the most satisfactory results no doubt, but the cost of the heliostat will, of course, prevent it from coming into general use except among those who desire to photograph what they observe, and the simpler methods above detailed will answer very satisfactorily for every other purpose.

The ammonio-sulphate cell used in either method should be made of two pieces of thin plate glass about two and a half inches square, held apart by thin strips of plate glass, or by a square of plate glass suitably drilled. The point is to obtain a layer of the blue solution about $\frac{1}{8}$ of an inch thick between two parallel planes of plate glass. The best cement for the purpose according to my experience is old Canada balsam applied hot; but many other devices may be employed. The solution is made by saturating strong *aqua ammonia* with sulphate of copper and should be strained or filtered so as to be free from all solid particles. A sheet of fine blue glass may be substituted for the ammonio-sulphate cell but only with tolerable results; at least, I have never had a sample of blue glass which was of just the right color.

The selection of the best condenser for high power definition is a matter which has recently elicited much discussion. In a general way I may say that any condenser will do its best work under the conditions above indicated if skilfully used. For the benefit of those who possess first class stands but have never purchased an achromatic condenser it may be stated that almost any objective suitably mounted on the secondary stage can be made to answer instead, the best results being attained when the angle of aperture of the objective thus used is rather less than that of the one employed to magnify the preparation, and when the secondary stage is capable of being centred or decentred at pleasure by screws working at right angles to each other. An ordinary low power objective (of one to three inches focal length) mounted on a separate stand and used to throw the light obliquely as already described is, however, perhaps the most convenient and efficient mode of illuminating lined test-objects with high powers.

As to the objectives suitable for monochromatic illumination,

the best compound objectives of some first class maker should be selected. It is a mistake, to suppose, as some have done, that a single lens can be substituted for the modern carefully corrected compound objective, even if the pure monochromatic light of a narrow portion of the solar spectrum as obtained by a prism were employed. For the objective always requires to be corrected for spherical aberration, and in the case of high powers must be provided with a screw collar to modify the distance between the posterior combination and the front one in accordance with the different thickness of the covering glass of the preparation. Now practically the spherical aberration is best corrected by the just combination of crown and flint glass, and combinations very nearly the same as those employed for white light would still be necessary if the objective were made for exclusive use with monochromatic illumination.

Under these circumstances I do not recommend the use of monochromatic illumination for low or medium powers except when photographs are to be made. It is only as an aid to high power definition that I here commend it. With its aid objectives incapable of resolving certain difficult tests (such as Amphipleura pellucida, Grammatophora subtilissima, etc.) with white light, show them in a satisfactory manner, and those which even with white light are capable of displaying the most difficult tests, exhibit them with greater clearness and distinctness. I attribute this result chiefly to the well known fact that the chromatic correction of our very best modern objectives is far from perfect, more or less of a secondary spectrum being always visible, and interfering with distinct vision. Moreover many of the objects we desire to examine are themselves capable of producing enough chromatic dispersion to interfere with our perception of their true form. Both these evils are escaped by the method here described. I do not advise it as a substitute for other modes of using the microscope, but as a special means of research to be reserved for occasional use in connection with the higher powers of the instrument.

I have frequently been asked to express an opinion as to whether the use of monochromatic sunlight is likely to prove injurious to the eye of the observer. On this subject I can speak from an extensive personal experience in connection with photo-micrography. The only injury to my own eyesight of which I have ever been conscious was produced by an injudicious exposure to the elec-

tric lamp. If the microscopist so manages his illuminating apparatus that the field of the microscope resembles in color and intensity the azure blue of the sky on a clear day (and this is the condition which should always be aimed at), I do not believe the use of the method for any reasonable time will be found injurious. I have recently found, when a sheet of plate glass backed with black velvet is substituted for the ordinary plane mirror in any of the above arrangements, that while the brilliancy of the light is much moderated, its desirable qualities are unchanged and it is still intense enough for the adequate illumination of the highest powers. Those who find the light obtained from the ordinary mirror too brilliant may resort to this contrivance with advantage.

SOME OF THE FAMILIAR BIRDS OF INDIA.

BY REV. H. J. BRUCE.

One is greatly surprised at the number of birds found in India. Dr. Jerdon in his "Birds of India," published in 1863, describes ten hundred and sixteen species, and since that time the list has been so much enlarged by new discoveries, that Mr. Allan Hume, in the second part of his "Rough Notes," announces thirteen hundred and sixty species as already acknowledged and identified. It cannot be supposed that this number includes all the avi-fauna of India, Burmah and Ceylon; for new species are constantly being discovered and added to the list as the number of observers is increased, and new localities are visited.

India possesses almost every variety of climate, from the snowy Himalayas on the north, to the arid plains and table-lands of the tropical south. The variety of surface, too, is very great. Whether upon the extended sea coast of several thousand miles, or upon the mountain cliffs and crags; in the immense forests of Malabar and Central India, or the thick jungles of the Ghauts and Ceylon; in the shady ravines or the open country; upon the large rivers and lakes or in the salt marshes, almost every kind of bird can find those conditions which are best adapted to its nature and wants. It is to be remembered also that this country forms the southern-

most limit of the Asiatic continent, and it is therefore the winter residence of a vast number of species which migrate from the colder regions of central Asia, and even from Europe. The Himalayan range forms no impassable barrier to them in their journeyings north and south; but, taking advantage of favoring valleys and mountain gorges, they have chosen for themselves great highways, over which they pass and repass as the changing seasons require. Dr. Stoliczka has recently discovered one of these highways in the valley of the Sutlej in the northwest Himalayas. This valley forms an almost direct passage through the lofty mountain ranges, from the plains of India to the elevated table-lands of Central Asia. In a distance of one hundred and ten miles it ascends from one thousand to thirteen hundred feet, and Dr. Stoliczka found there many species of birds which one would not expect to find in such an elevated mountainous region.

Rahouri is situated on the bank of the Mûla river, in the broad valley of the Godavery, twenty-three miles northwest from Ahmednuggur. The country round about is open plain, and the land for the most part is fertile. Immediately around the village are a large number of gardens which are more highly cultivated and irrigàted by water drawn from wells by bullocks. There are a great many trees, of various kinds, in these gardens, and it is therefore a favorable locality for many of our familiar birds. Without attempting to include in this list all the birds found here, I propose to restrict myself to those which I have seen from my study window, and in my own garden. In front of my window, one hundred feet distant, is a thick hedge of Milkbush (*Euphorbia tirucalli*) fifteen feet high, and upon either side of the intervening space are a number of acacias and other trees. The garden is a much larger enclosure, surrounded by the same hedge and containing many trees of different kinds. With limits thus circumscribed, our list will, of course, include only a few of the most familiar birds.*

Neophron Ginginianus. The white scavenger vulture. This was formerly supposed to be *N. percnopterus*, the "Pharaoh's chicken" of Egypt, but is now acknowledged as a distinct race.

Hieraëtus pennatus. The dwarf, or booted eagle. Often seen among the common kites, and it so much resembles them in size

* With two or three exceptions all the birds included in this list, and many other Indian species, may be seen in the Museum of the City Library Association in Springfield, Mass.

and general coloring that the inexperienced observer finds it difficult to distinguish the two when flying at a little distance from him. It is wary, but more predacious than the kites, not unfrequently seizing a chicken or some other small animal from the ground. But, as Dr. Jerdon says, its depredations are usually laid to the charge of the kites, for the reason that the common native people do not distinguish it from them. It is wonderful how widely extended the range of this eagle is. It is found throughout India and Burmah, in Western Asia, Southern Europe and Northern Africa, and has recently been reported from South Africa. Mr. Blyth also thinks that the Australian *Hieraëtus morphnoides*, is not to be distinguished from this species.

Poliornis teesa. The white-eyed buzzard.

Milvus Govinda. The common pariah kite. Among the first objects that attracted my attention when I landed in India were the kites and crows, and I have scarcely been out of sight of them very long at a time since. They are very abundant in all parts of India, and no representation of Indian scenery would be quite complete without some of these birds in the foreground. The common kite performs a very important office as a scavenger. It is generally seen sitting upon the ground, or upon houses or trees, or sailing about with easy and not very rapid motion over the villages or cantonments watching for any bits of refuse which may serve for food. When these are discovered the kite does not think it necessary to light upon the ground to secure them, but swooping rapidly down it seizes the prize with its claws; or if the first swoop fails a second or third quickly follows. But after seizing the coveted morsel he is a lucky fellow if he is able to retain it. Others of his own species seeing his success, will sometimes rush upon him and attack him with such fury that he is ready to drop the prize to escape from them. If unmolested, however, he will devour his spoils either upon the wing, or seated upon some neighboring house or tree. It is surprising how quickly the kites will discern an object and recognize it as an article of food. I have myself thrown a small bird out upon the ground with considerable force, and almost before it stopped rolling upon the ground, a kite, which was unseen before, swooped upon it and carried it away in triumph.

The kites are sometimes exceedingly bold and often very troublesome. The people in this country are accustomed to carry almost

every kind of burden upon the top of their heads, and it is no uncommon thing for a kite to make a sudden swoop and possess himself of a part of their burden, when it is anything that he desires for food. I have seen them attempt to seize food out of the hand of a man. It was done so quickly that the audacious robber, whether successful or not, was far away before the astonished victim could recover from his surprise. They consider it, however, much safer to take liberties with children than with older people. Several years ago my own child, then two years old, was accustomed to take a piece of bread in his hand and go out each afternoon to play in the shadow of the bungalow. On several successive days we were suddenly aroused by a great outcry from the child, and on going to him found that a kite had unceremoniously robbed him of his food. I made every effort to shoot the troublesome bird, but, as if aware of my purpose, it quickly disappeared whenever I came in sight. At length, however, after several days' manœuvring, quite contrary to its usual custom it cautiously flew over my head, and—well! it troubled the child no more.

Mr. Hume says that "there are certainly two distinct species of kites in India." The second species is much larger than *M. Govinda*, and Mr. Hume has named it *M. major*. It is "a wild wary bird, very difficult to approach and is found only in the open fields, or in swamp or jungle." Hence very few specimens of this "larger kite" have ever been obtained, although it has been repeatedly seen, recognized and pursued, both by Mr. Hume and others. Besides this, Mr. Hume thinks that it is by no means improbable that the Australian *M. affinis* and the Chinese *M. melanotis* may be found within our limits. The Indian kites seem never to have been examined with that thoroughness with which most other families of Indian birds have been. Certain it is that in the great multitude of kites all about us, there is a vast difference in many of the individuals, both in respect to size and coloring; but whether this is owing to a difference of species, or only to the conditions of age and sex, can be determined only by careful examination of a large series of specimens. *Milvus Govinda* seems to be nearly confined to India, Burmah and Ceylon. A few specimens only have been recorded from the Andaman Islands.

Athene Brama. The spotted owlet.

Cypselus affinis. The common Indian swift. Very abundant

at times, even entering verandahs and houses, and then again not seen at all for many months.

Caprimulgus Asiaticus. The common Indian nightjar.

Caprimulgus———. Nightjar. A single specimen shot upon the ground close beside the bungalow. It is of a remarkably light color, and apparently differs from any described by Dr. Jerdon.

Merops viridis. The common Indian bee-eater. There are three Asiatic varieties of this bird which Mr. Blyth thinks are "about as well worthy of separation as is the African variety from either one of them." The blue-throated variety, or Hodgson's *M. torquatus*, seems not to be uncommon in this region.

Coracias Indica. The Indian roller. This beautiful bird is regarded by the natives with great superstition. If the traveller sees it sitting upon his right, and can pass without raising it, it is a good sign; but if it is on his left he despairs of accomplishing the object of his journey. Hence he will sometimes run with all his might across the neighboring field in order to leave the bird upon the right hand side of his path.

Palæornis torquatus. The rose ringed parrakeet. Very abundant and noisy, and destructive to the crops of fruit and grain. It flies with great energy, and when on the wing always seems to be *in a hurry*.

Hantholæma Indica. The crimson-breasted barbet. The only barbet found in this region.

Coccystes melanoleucus. The pied-crested cuckoo.

Centropus rufipennis. The common coucal or crow pheasant.

Arachnecthra Asiatica. The purple honey-sucker. This is the most widely spread of all the Eastern sunbirds. The male, in breeding plumage, with its glossy, purplish black body, and crimson and yellow axillaries, is a very beautiful object. Of the thirteen species of Indian honey-suckers this is the only one found in this vicinity.

Upupa nigripennis. The Indian hoopoe.

Lanius erythronotus. The rufous-backed shrike.

Lanius Hardwickii. The bay-backed shrike.

Pericrocotus peregrinus. The small minivet.

Dicrurus macrocercus. The common drongo shrike.

Tchitrea paradisi. The Paradise flycatcher. A single specimen, a fine adult male, shot in the hot season of 1869. It is com-

mon in the more highly wooded districts along the Western Ghauts.

Leucocerca albofrontata. The white-browed fantail. An occasional visitor to the trees in front, and always welcome for the beauty of its song as well as the oddity of its manners.

Cyornis banyumas. Horsfield's blue red-breast. The female of this bird is not, as Dr. Jerdon supposes, "olive brown above." I have repeatedly obtained undoubted females, determined by dissection, which differed from the males only in having the colors slightly more dull. An allied species, *C. ruficauda* has been found in this vicinity, but all my specimens have proved to be females. It is still a question whether this last is a good species, or whether it is the female of some other race.

Petrocossyphus cyaneus. The blue rock thrush. According to Dr. Jerdon and the Rev. H. B. Tristram this, and not *Passer domesticus* is the "sparrow" of Ps. cii, 7, that sitteth "alone upon the housetop."

Malacocircus Malcolmi. The large gray babbler. Very abundant and exceedingly noisy.

Pycnonotus pusillus. The common Madras bulbul. Distinct from the *P. hæmorhous* (Gmelin) of authors.

Oriolus kundoo. The Indian oriole.

Copsychus saularis. The magpie robin.

Thamnobia fulicata. The Indian black robin.

Ruticilla rufiventris. The Indian redstart.

Acrocephalus dumetorum. The lesser reed warbler.

Prinia socialis. The dark ashy wren warbler.

Drymoipus longicaudatus. The long-tailed wren warbler.

Phyllopneuste rama. Sykes' warbler.

Sylvia affinis. The allied gray warbler.

Motacilla Dukhunensis. The black-faced wag tail. During the cold weather when this bird is with us its whole face to the top of its head is pure white. The observer in this latitude therefore fails to see the propriety of the English name that has been given to it.

Budytes viridis. The Indian field wagtail. The green wagtails are very difficult of identification. Mr. Hume thinks that there are at least six species in India, only two of which occur in Dr. Jerdon's list.

Corvus culminatus. The carrion crow. Of the seven species

of crows found in India only two are seen here. This species is very common but not nearly so abundant as *C. splendens.* I have never been able, however, to obtain specimens which approached in size the measurements given by Dr. Jerdon. The largest specimen, I think, that I ever obtained, measured but nineteen inches in length, whereas Dr. Jerdon gives its length as twenty-one inches.

Corvus splendens. The common Indian crow. The common Indian crow is everywhere found in surprising numbers, and it retains all the wariness and cunning which are characteristic of its class. It is amusing to see its excessive caution when it has reason to think that one has evil designs concerning it. It stands with its neck stretched forward and its wings partly spread ready for instant flight, while its eye is cocked and it watches every indication of war or peace. The slightest hostile movement, or even a steady look will often send it away; but sometimes it seems to know that it is being imposed upon, and then it merely jumps upon a more distant branch of the tree, or if on the ground flies a few feet away. It is exceedingly quick to comprehend the situation of affairs, and to avail itself of any opportunity to secure its food.

I once saw, in the city of Poona, an old woman sitting by the roadside with a basket of sweetmeats for sale. Not finding trade very brisk, however, she had leaned her head against a tree and fallen asleep. The crows seemed to comprehend the case at once, and they began to sidle up, in their own peculiar way, to help themselves to the contents of the basket. Probably the old woman found them anything but profitable customers.

There seems to be an element of justice in the constitution of this crow, as well as in some of its congeners, at least they are accustomed occasionally to inflict punishment upon certain guilty members of their community. I was once fortunate enough to witness their administration of justice. Hearing an unusual commotion among the crows in my garden I went out to see what was the trouble. A large number of crows were assembled and were mostly standing upon the ground. In the midst of them was one which seemed to be the prisoner, and three or four others which were apparently the executioners. They fell upon the prisoner with great violence, pecking him upon the head, pushing him, and pulling his feathers, while the prisoner meekly submitted to his punishment without trying to escape or to retaliate. I did not

learn what crime the prisoner had committed, but, judging from the punishment he received, it must have been very great. When the punishment had been inflicted and justice maintained, the prisoner was released. After standing quietly for a moment he flew away, and was probably ever afterward "a sadder and wiser" crow. The court also adjourned, and the assembly broke up.

It is often mentioned of this crow that it roosts in company, in vast numbers, assembling for that purpose from the whole surrounding country. The late Capt. Beavan says, "At Umballah I have observed crows in large numbers flying along the grand-trunk road over twenty miles of an evening, for the sake of roosting in the station, returning in the morning the same distance." There are some large trees in the Collector's garden at Ahmednuggur which serve as a roosting place for these birds. From before sunset until dark the crows may be seen in great numbers coming from all directions for their night's lodgings, and in the early morning they return again to their various hunting grounds. I will venture to say that they are the most industrious collectors of revenue that emanate from that place.

Acridotheres tristis. The common myna. This is one of our most common and familiar birds; and it is rather a favorite, partly because of its cheerful and *dignified* appearance, and partly because it has such a great variety of notes; more than once have I heard a strange, unknown song, and on going to my window to discover its source have found only my old friend the myna. Some of its notes are not very musical, it is true, but they are always so cheerful, so rollicking, that it is a pleasure to have it about. There is one striking peculiarity about this bird. It has a row of white or silvery specks around its red-brown irises. This when seen near at hand gives it a singular appearance. So far as I know, none of its allies has this peculiarity.

The myna is by no means a timid bird. It is able to stand upon its dignity and to defend its rights when occasion reqnires. Mr. Hume speaks of a male in defence of his household treasures, "rushing after and soundly thrashing any chance crow (four times his weight at least) that inadvertently passed too near him." I have seen a pair of them in front of my window attacking most furiously a medium sized cobra that came within a few rods of their nest. His snakeship was making the best of his way to a neighboring hedge, when, without waiting for the formality of

putting on my hat, I seized a stick and ran out in the hot mid-day sun to the assistance of the brave birds. After a short conflict the reptile was safely housed in a bottle of alcohol.

The common myna has been successfully introduced into the Mauritius and Andaman Islands. Dr. Carpenter says of this bird, "In the Mauritius, the increase of locusts, which had been accidentally introduced there, and which were becoming quite a pest, was checked by the introduction from India of a species of bird, the grackle, which feeds upon them." (Animal Physiology, Paragraph 149.) Why might it not be introduced into the Southern States of America? It thrives in Northern India in latitude equal to that of the Gulf States, and at an elevation of five thousand feet.

Temenuchus pagodarum. The black-headed myna. This species is more seasonal in its appearance, and is far more quiet and retiring in its habits than the common myna. It is a beautiful little bird, and, as Mr. Hume says, "there is something essentially gentlemanly in his look; he is always so exquisitely glossy, neat and clean, and he always looks so perfectly independent and so thoroughly good humored."

Pastor roseus. The rose-colored starling. The rose-colored starlings are said to breed in Western Asia and in Southern Europe. They make their appearance here during the cold season in time of harvest, and make great devastation in the fields of grain. In the evening they assemble in countless numbers at their chosen roosting places, either in trees, or in a thick growth of prickly-pear. I have seen them in vast cloud-like flocks flying back and forth over their roosting place for several minutes, and then they would suddenly dart, like an arrow, into the prickly pear and settle themselves for the night. On one occasion one of these flocks was fired into on two nights in succession, and on the third night, not a starling was to be seen at that place.

Munia Malabarica. The plain brown munia.

Passer Indicus. The Indian house sparrow. One does not always have to look out of the window to get a glimpse of the Indian house sparrow. They are abundant everywhere, in the house and out of it, and they are as mischievous and impudent as they are common. They are exceedingly industrious and persevering in their mischief, working away for days and weeks at any little hole they may find in the walls and ceiling until they have

enlarged it sufficiently to give entrance to themselves and the rubbish which they require for their nests. Its chirp is loud and shrill, and is continued with such pertinacity as to become extremely annoying. Indeed Dr. Jerdon pronounces this bird and the common squirrel (*Sciurus palmarum*) "two of the greatest pests in India." The ill-mannered creature has no regard for sacred places, but enters the churches and chapels with the utmost freedom, screaming out its loudest notes, being provoked thereto, perhaps, by the singing of the congregation. I have been almost distracted when preaching to a native assembly, by half a dozen or a dozen of these noisy creatures chirping with all their might over my head and in every part of the room. It is of little use to drive them out; for if they are driven out through the door they will come in at the window, and if through the window they will return at the door. Their persistence is more than a match for human patience, nothing short of decapitation seems to be sufficient to keep them from their mischief. I have suddenly closed the doors and windows upon them, and chased them back and forth until in their fright they have fallen helpless to the floor; have taken them in my hand and done everything to frighten them, but out of sheer pity have let them go alive, only to have them return to their work of destruction at the first opportunity.

I have been more particular in describing this bird because of the recent attempt to introduce a closely allied species (*Passer domesticus*) into America. I confess that I look with some apprehension upon these efforts which I believe to be ill-advised and inexpedient. The European house sparrow does not differ essentially in its habits from its Indian ally, and so far as I can learn, it is very generally regarded as a nuisance wherever it abounds. In some parts of England a bounty is placed upon its head and considerable sums of money are paid for its destruction. In Spain it is said by Mr. Howard Saunders to be "as abundant and impudent as elsewhere." The *Passer domesticus* is the common sparrow of Syria, according to the Rev. H. B. Tristram, who says of it, "in its westward migrations it has acquired neither additional impudence, assurance nor voracity." Dr. Thomson also describes these same Syrian sparrows in the following spirited style. He says: "They are a tame, troublesome, and impertinent generation, and nestle just where you don't want them. They stop up your stove and water pipes with their rubbish, build in the windows and under the

beams of the roof, and would stuff your hat full of stubble in half a day if they found it hanging in a place to suit them. They are extremely pertinacious in asserting their right of possession, and have not the least reverence for any place or thing." (Land and Book, Vol. 1, page 58.)

If the sparrow is to be introduced into America to devour the larvæ of insects it should be remembered that it is for the most part a feeder on grain, seeds and buds and that it only makes a business of devouring grubs during its breeding season. If it is true, as has been estimated, that a pair of them will devour four thousand caterpillars a week during their breeding season, still that season continues but a small part of the year, during the remainder of which they may cause a great amount of destruction.

I trust that those who have to do in this matter will act advisedly, lest they should introduce that which will eventually become as great a nuisance, in its way, as the curculio and the cankerworm.

Of the five other species of Indian sparrows only one is found in this region. The *Passer flavicollis*, or yellow-necked sparrow, is altogether more modest than the preceding, and is, indeed, a very different sort of a bird. It does not intrude itself into the society of man, but frequents thin forest jungle, groves of trees and gardens. It has a very pleasing song which it pours forth from its golden throat, seated upon the topmost twig of some lofty tree.

Emberiza Huttoni. The gray-necked bunting. This can hardly be called a familiar bird in the sense to which we have restricted that term, although I have *twice* seen it gathering its food upon the ground in front of my window; I mention it here more particularly to correct an error in regard to its supposed limited distribution. Dr. Jerdon gives its habitat as the N. W. Himalayas, but thinks it may be "a rare straggler into Western India." Mr. W. T. Blanford obtained four specimens in 1867, in the vicinity of Nagpore and Chanda, and reports them as having "not previously been found so far to the South." Rahouri is considerably farther south than the places mentioned by Mr. Blanford, and I have seen them here in large numbers during the past year. I cannot however explain the apparent suddenness of its appearance. I never saw it to recognize it until two years ago, and then only a few specimens, but during the last cold season it was very common, in various localities of hill and plain.

Euspiza melanocephala. The black-headed bunting is present

in vast multitudes during the cold season, and this year (1871), up to the first week in April, a whole month later than is mentioned by Dr. Jerdon.

Columba intermedia. The blue rock-pigeon.

Turtur Cambayensis. The little brown dove. Very abundant and tame, building its nest sometimes on the verandah within reach of the hand.

Turtur Suratensis. The Spotted Dove. Occasional. Very beautiful.

Turtur risoria. The common ring-dove. Very abundant. This is a very widely distributed species. It is one of the three common doves of Palestine, and is found in Asia Minor, and even in European Turkey and Northern Africa. It has also been introduced into New Zealand.*

Ortygornis Ponticeianra. The gray partridge. Often seen in small companies about the hedges.

Anthropoides virgo. The demoiselle crane. A very common and beautiful sight in the cold season is a flock of these magnificent birds flying overhead. They are generally in a straight or wedge-shaped line, and sometimes form a double line. They usually number from twenty-five to a hundred in a flock, but they sometimes appear in astonishing numbers. Occasionally, too, they rise to an immense height, so as hardly to be visible, or even to disappear behind the clouds. During the day they sit in the sandy beds of rivers, but they are very shy and difficult to approach.

REVIEWS AND BOOK NOTICES.

Scientific Record.† — We are glad to see that the admirably edited "Scientific Intelligence" which the Messrs. Harper have been publishing of late in their Weekly and Monthly has been put

* I have observed a very curious habit of this bird which I never saw noticed in any published account. A sudden shower of rain was one day falling after some weeks of dry weather. On going to my verandah I saw, not far off, numbers of these birds lying upon the ground, mostly upon one side, with the opposite wing spread and bent as far as possible over the back. I watched them for some time and found that their object was evidently to cool themselves by allowing the large raindrops to fall upon the thinly clad portions of the body under the wing.

† Annual Record of Science and Industry for 1871. Edited by Spencer F. Baird, with the assistance of eminent men of science. New York; Harper and Bros. 1872.

in more permanent and accessible form, with the addition of a good deal of matter, original and compiled, which was not suitable for the columns of a popular periodical. Professor Baird, of course, needs no introduction to the readers of the NATURALIST, nor is any endorsement of the quality of work he offers, required; we may simply say that in points of perspicacity, comprehensiveness and thorough reliability, the present volume matches former ones from the same high source. Those who have not seen the "Record," may be interested to know that it is a digested and methodically arranged abstract of the leading scientific discoveries of the past year, representing the cream of current literature in Science and Industry. It will prove an extremely useful and convenient handbook to all who desire a general knowledge of what is going on in the scientific world, and recommends itself particularly to the large class whose tastes have made them readers and friends of the NATURALIST. — E. C.

THE BOSTON SOCIETY'S ORNITHOLOGICAL CATALOGUE.* — We are informed by Prof. Hyatt that "a catalogue of the birds in the possession of this Society is here begun" — a statement alone sufficiently interesting; and after a particularly thorough examination of the first number, it is the more gratifying to learn that "*similar* series of observations upon the genera and species will be published." The value of even a bare museum catalogue is appreciated by working ornithologists; and how very important this class of work may be made, is shown by the position that Schlegel's work on the Leyden museum has taken. With a due sense of what is implied in the remark, we judge that if Prof. Hyatt continues to work in the same vein, the Society's "Catalogue" will compare favorably with the one just mentioned. It is true that we recognize, by many tokens, a hand unaccustomed to work in this particular department, but it is equally true that we find the subject adequately and successfully treated; it receives a fresh and vigorous touch bringing out some points that have not hitherto received due attention. The author shows plainly the qualities of the trained naturalist, which have distinguished him in his own specialties. The specific determinations, to which we assent in every instance, are the same, for the nine species in the collection, as

*Catalogue of the Ornithological collection in the Museum of the Society. I. *Spheniscidæ*. By Alpheus Hyatt. 1871.

those of Dr. Schlegel's; the birds are, however, referred to four genera, instead of one, and for this, excellent reason appears. We would only remark in the matter of synonymy, that *Aptenodytes* "*Pennantii* GRAY" is antedated by "*longirostris* SCOPOLI," while "*papua* FORST." should be cancelled, on the score of being geographically inept, in favor of "*tæniata* PEALE." Our own slight connection with the paper, in the shape of some osteological memoranda, must of course not stand in the way of our according the high praise that Prof. Hyatt's work merits. — E. C.

DESCRIPTION OF A SPECIMEN OF BALÆNOPTERA MUSCULUS.* — As is well known, no mammals more rarely fall under the observation of naturalists than the larger Cetacea, and hence the detailed and careful description and illustration by figures, of the skeleton of even a common species, is a valuable contribution to science. As a group, the Cetacea apparently present a remarkable range of individual variation, in consequence of which both species and genera have been unduly multiplied, a large number of supposed species being at present known only from single and often imperfect specimens, and in some cases merely from a few disconnected bones. Those who have had an opportunity of studying the largest number of specimens appear generally disposed to favor a considerable reduction of the number of described species. In the present memoir, Dr. Dwight has given a detailed and very satisfactory description of the osteology of apparently our most common species of finback whale, which he believes to be identical with the *Balænoptera musculus* of Van Beneden and the older authors, or the *Physalus antiquorum* of Dr. J. E. Gray.

"The task undertaken," the author observes, "is to add one to the list of thoroughly described skeletons, and to endeavor to show that the range of purely individual variations is greater than is generally admitted." In addition to the description of each bone, and generally a comparison of it with the published descriptions and figures of other specimens, he has added an interesting table, showing the comparative breadth of the skull and beak of eleven described specimens, which indicates that while the Society's specimen scarcely differs from the average, the range of

* Description of the Whale (*Balænoptera musculus* Auct.) in the possession of the Society; with remarks on the classification of Fin Whales. By Thomas Dwight, Jr., M.D. Mem. Bost. Soc. Nat. Hist., Vol. II, pp. 203-230. 11 woodcuts and 2 plates. June, 1872. (Read May 17, 1871.)

variation, in the proportion of the elements mentioned, amounts to nearly twenty per cent. of the average. "In some cases," Dr. Dwight observes, "both skull and beak exceed the average breadth; in others both fall short of it, and again, in others sometimes one part, and sometimes the other is out of proportion." From the general consideration of the subject, Dr. Dwight seems to favor the opinion that the so-called *Physalus Duguidii* is hardly distinguishable from the present species. He further remarks:

"When the large number of points in which this whale is peculiar is considered, it can not be denied that bolder feats in classification have been attempted than would be requisite to found a new species on this specimen. Such a course, however, would be quite unjustifiable. It is to be particularly noticed that these variations do not point in any one direction; that if in certain aspects this specimen approaches a certain other, yet in others equally important, it may resemble a third which is quite unlike the second, and in still other respects be different from both. A slight study of the writings of the eminent observers so often quoted will be sufficient to show that the same is true, to a greater or less extent, of perhaps every well described specimen of the species." (p. 229.)

Besides the woodcuts illustrative of many of the bones, a large lithographic plate is devoted to figures of the skull and other important osteological features, and in another plate are given dorsal, ventral and profile views of the animal, accurately drawn soon after its capture by Mr. J. H. Blake, of the Museum of Comparative Zoölogy, and also a table of external measurements. —J. A. A.

THE HABITS OF THE ORCA.* — It is not often that we find in popular magazines of the day, articles on natural history subjects containing original matter of a character that commends them to the attention of naturalists. But in this very readable paper of five pages, Captain Scammon has given us valuable information respecting the habits, distribution and external characters of a little known group of marine mammals, — the Orcas, or the carnivorous Cetacea, of the Pacific Coast of North America, — based on many years of personal observation. The apparently fabulous

* The Orca. By Capt. C. M. Scammon. Overland Monthly, July, 1872, pp. 52–57, with three outline figures.

stories of the strength and voracity of the "killers," popularly current among seafaring men, seem now hardly exaggerations of the truth. Though apparently only rarely attacking the larger cetaceans, they prey with great rapacity upon their young and the smaller species, as well as also upon seals and the larger fishes. Even the powerful old male sealions and the full grown walruses, are said to endeavor to avoid them, while their ability to kill the largest of the baleen whales seems fully established. The species of "killer" chiefly referred to in this article appear to be the *Orca ater* and *O. rectipinna* of Cope, though possibly a third species is figured. The same enterprising magazine has at former times furnished us with other articles of value from Capt. Scammon's ready pen, respecting other marine mammals of the Pacific Coast, among them valuable papers on the Sea Otter ("Overland Monthly," Vol. IV, Jan., 1870, pp. 25-30), and the sealions and seabears (*Ibid.*, Vol. VIII, Mar., 1872, pp. 266-23). We are glad to learn from Captain Scammon (incidentally in a letter to the writer) that he proposes soon to collect his various articles on the seals and whales of the Pacific and republish them in book form, accompanied with illustrations and much additional matter,—a work which his long familiarity with them eminently qualifies him to prepare, and which will be heartily welcomed by naturalists, as well doubtless as by the general public.—J. A. A.

HOW PLANTS BEHAVE.*—Dr. Gray has just given us, under this title, a most charming continuation of his Botany for Young People, commenced in the well known volume, "How Plants Grow." Like that volume it gives a simple and well illustrated account of the phenomena of plant life, all the more to be enjoyed, because the author's scientific eminence guarantees its entire agreement with the last established facts and theories in Botany. The plan of the book is thus stated in the preface:

"There is a study of plants and flowers admirably adapted, while exciting a lively curiosity, to stimulate both observation and thought, to which I have long wished to introduce pupils of an early age. The time has now arrived in which I may make the attempt, and may ask young people to consider not only 'How

* Botany for Young People: Part II. How they move, climb, employ insects to work for them, etc. By Asa Gray. pp. 46. 12mo, with 40 illustrations. New York and Chicago. Ivison, Blakeman, Taylor, & Co. 1872.

Plants Grow,' but how plants Act, in certain important respects, easy to be observed,—everywhere open to observation, but (like other common things and common doings) very seldom seen or attended to. This little treatise, designed to open the way for the young student into this new, and, I trust, attractive field, may be regarded as a supplement to the now well-known book, the title of which is cited at the beginning of this prefatory note. If my expectations are fulfilled, it will add some very interesting chapters to the popular history of Plant-life.

"Although written with a view to elementary instruction, and therefore with all practical plainness, the subjects here presented are likely to be as novel, and perhaps as interesting, to older as to young readers.

"To those who may wish to pursue such studies further, and to those who notice how much is cut short or omitted (as, for instance, all reference to discoverers and sources of information), I may state that I expect to treat the subject in a different way, and probably with somewhat of scientific and historical fulness, in a new edition of a work intended for advanced students."

The book contains three chapters of unequal length. Of these, the first describes the motions of plants and how they climb. The third chapter takes up the very curious fact that certain plants, for the most part in their leaves, possess living and very efficient insect-traps. The Pitcher-plant and Sundew are figured and described. In naming the volume "How Plants Behave," Dr. Gray appears to recognize a personality in plants—at least he is careful, all the way through, to show that the actions which he explains are the result of the plant's will; and just as far as botanical science allows, he assigns the reasons for them. The following, from his account of the Venus' Flytrap of North Carolina shows the ambitious hunger which may make a plant carnivorous:

"It cannot be supposed that plants, like boys, catch flies for pastime or in objectless wantonness. Living beings though they are, they are not of a sufficiently high order for that. It is equally incredible that such an exquisite apparatus as this should be purposeless. And in the present case the evidence of the purpose and of the meaning of the strange action is wellnigh complete. The face of this living trap is thickly sprinkled with glands immersed in its texture, of elaborate structure under the microscope, but

large enough to be clearly discerned with a hand lens; these glands, soon after an insect is closed upon, give out a saliva-like liquid which moistens the insect, and in a short time (within a week or two) dissolves all its soft parts — digests them, we must believe; and the liquid, with the animal matter it has dissolved, is reabsorbed into the leaf! We are forced to conclude that, in addition to the ordinary faculties and function of a vegetable, this plant is really carnivorous."

But by far the most interesting part of the book is the second and longest chapter, which takes up the Fertilization of Plants by Insects. There are especially two things for which we have to thank Dr. Gray, besides the general charm of his writing upon this theme. He has given us the simplest and most comprehensive statement of this great subject which we have seen, and it is no small advantage to have the enthusiasm of a thorough student of Botany turned to the work of instructing others. But in addition, he has taken his illustrations largely from common flowers, such as the Houstonia, Kalmia, Arethusa, Iris, etc., and has figured each with great beauty and accuracy. He has a word upon each of the many peculiarities in the arrangement of their stamens and pistils which plants present, and shows that instead of being limited to any one family, as to the Orchids, the agency of insects is very largely employed by all families of plants. It is impossible to quote from this chapter where all is so interesting, unless we give a word or two of Dr. Gray's summary, where the flowers of an estimable theologian's poetry are themselves fertilized in the interest of Science:

"The reciprocity of flower and flower, and of insects and flowers, is something admirable. Insects pay liberal wages for the food which flowers provide for them. The familiar rhymes of Dr. Watts directed the attention of young people to the bee visiting the flower as a model of industry. With a slight change of a couplet, adapting it to our present knowledge and to the lesson of mutual helpfulness, we may read:—

How doth the little busy bee
Improve each shining hour,
While gathering honey day by day,
To fertilize each flower."

The paper, print, and illustrations of this little volume are especially good. The vignette title page is an excellent grouping of the various plants described within. — E. C. B.

ORNITHOLOGICAL WORKS IN PROSPECT. — The present year promises to be a marked one in the history of North American Ornithology, no less than four important works on the subject being already in press, and nearly all so well advanced that their publication will probably not be long delayed. First, in respect to time of appearance, will apparently be the "Key to North American Birds,* by Dr. Elliott Coues, a gentleman well and favorably known to the ornithological public through his admirable series of memoirs on various groups of our birds. The greater part of this work is already in type, and its publication, may be expected early in the coming autumn, the prospectus of the work having already been issued. Through the kindness of the publishers we have been favored with advance sheets of the portion printed, and can hence speak the more confidently of its character. The work is divided into three parts, — a general "Introduction," an analytical "Key" of the genera and subgenera, and a general "Synopsis" of the species. The *Introduction* gives a popular elementary exposition of the leading principles of ornithology, in which especial attention is paid to the description of the external parts and organs of birds, which are illustrated by appropriate figures. The definition of the technical terms in common use in ornithological writing is particularly full and clear, surpassing in this respect any similar treatise on the technicalites of the science with which we are acquainted. The *Key* forms a novel feature in zoölogical manuals, constituting an artificial analysis, in a continuous table, of the genera and subgenera, similar in character to the analytical keys that have been so successfully introduced into botanical manuals. In connection with the definitions of terms contained in the Introduction, the student is guided at once to the identification of any specimen of North American bird he may have, however slight his previous experience. It hence forms an invaluable feature of the work to collectors and amateurs. In the *Synopsis* that follows, the species are arranged in an approved systematic sequence, and are very fully and concisely described, all the characters which are really distinctive and essential being given without confusing the student with unimportant details. A large number of full length figures,

*Key to North American Birds: containing a concise account of every species of living and fossil bird at present known from the continent north of the Mexican and United States Boundary. Illustrated by 6 steel plates and upwards of 250 woodcuts. By Elliott Coues, Assistant Surgeon United States Army. Salem: Naturalists' Agency. 1872. Imperial 8vo, cloth.

and over two hundred figures illustrating the head as well as the feet and occasionally other parts, add greatly to the value of the work. The higher groups are also quite fully characterized, and in connection with their diagnoses much general matter of interest is presented. Although the work is not to any great extent biographical, the leading traits of the various groups and of most species are tersely presented, and the geographical distribution of each quite fully stated. The author makes a considerable reduction in the number of species that have hitherto been generally accepted, assigning a few to the list of synonymes, but by far the greater part of the reduction results from a judicious discrimination between species and geographical varieties, — a reform urgently demanded by the advance of science. By this means the rank and relationship of the different forms described is clearly expressed.

Another important feature of the work will be a synopsis of the fossil birds of North America, which will furnish the student with the first connected presentation of the subject that has been made, embracing a summary of the different disconnected descriptions of our fossil birds, which at present are to be found only in the original memoirs scattered through the proceedings and transactions of scientific societies.

The typographical appearance of the work is all that can be desired, and would be a credit to any publishing house. It is printed on toned paper, and illustrated by six steel plates and about two hundred and fifty woodcuts.

It is unquestionably destined to rank, as a text-book of North American Ornithology, as a work of equal importance, in its own province, with "Gray's Manual of Botany" and Packard's "Guide to the Study of Insects," in their respective fields, thus forming to the inexperienced student an invaluable guide, and a convenient work of reference to those more advanced; while its moderate cost places it within the reach of all. While its limits prevent a complete citation of previous authors, all our general works are cited, including the older works of Wilson, Nuttall and Audubon, and Baird's elaborate and indispensable general works, and numerous original papers in the publications of scientific societies.

The most complete work on North American Ornithology,* yet

* The Birds of North America. By Prof. Spencer F. Baird, with the coöperation of Dr. T. M. Brewer and Mr. Robert Ridgway. Little, Brown, and Co., Boston. 1872.

published or in prospect, is doubtless that recently announced by Messrs. Little, Brown and Co., of Boston. This will be an entirely original work, prepared by Professor S. F. Baird, Assistant Secretary of the Smithsonian Institution, with the coöperation of Dr. T. M. Brewer of Boston and Mr. Robert Ridgway of Illinois. The well known scientific attainments of these gentlemen will warrant the public in anticipating a thorough treatment of the subject, since their facilities are unequalled and their ability unquestionable. That such a work is at present greatly needed must be apparent to every one at all familiar with the subject, since our latest general treatise on the habits of the birds of this continent is that of Audubon, published nearly a third of a century ago, when the vast regions north of Canada and west of the Missouri River were almost a *terra incognita*, especially in respect to ornithology. Fourteen years have also passed since the publication of the last general work on the technical ornithology of this country, during which interval our knowledge of the subject has vastly increased. In addition to an exhaustive treatment of the technical portion of the science, the present work will contain full biographies of the species, including a large amount of original matter. As announced in the prospectus, the object of this work "is to give a complete account of the birds of the whole of North America, north of Mexico, arranged according to the most approved system of modern classification, and with descriptions which, while embodying whatever is necessary to the proper definition of the species and their varieties, in as simple language as possible, exclude all unnecessary technicalities and irrelevant matter." The work is said to be in an advanced stage of preparation, the first volume being promised by the 1st of December, to be followed by others during the winter, the whole to be comprised in a series of probably four volumes, the land birds perhaps occupying three; all the volumes will be profusely illustrated. The illustrations are to consist of a series of outlines of the wings, tail, bill and feet of each genus, with a series of full length figures of one species of each genus, in addition to a series of plates. The work is to be furnished in two editions, one plain and the other with the plates carefully colored by hand. The publishers feel justified in promising a work that in many respects will be as marked an advance beyond its predecessors as was that of Audubon; and that in typographical excellence and in the accuracy and

beauty of its illustrations it will surpass anything of the kind ever published in America or in Europe. From a careful examination of advance sheets of the greater part of the first volume we feel sure it will not disappoint the expectation thus awakened.

We are also promised the early appearance of a valuable original work on the birds of Florida,* by Mr. C. J. Maynard of which the prospectus was issued a short time since. This is announced to be published in twelve parts, and to contain original descriptions of two hundred and fifty species, with full biographical notices, and to be illustrated with five plates drawn and colored from nature. As Mr. Maynard has spent the greater part of three years in Florida, devoting himself exclusively to ornithological pursuits, and has visited all parts of the state, including the Keys and the Everglades, we are led to expect much valuable information, in respect to the birds of that little known region. While the biographical part is written in an animated, popular style, the technical details will render it a work of importance to the scientific student. It is to be issued of full quarto size, and judging from the sample pages, its typographical execution will be excellent.

A fourth work on North American Ornithology, now in press, is the Ornithological Report of Mr. Clarence King's exploration of the Fortieth Parallel, prepared by Mr. Robert Ridgway. This we understand will be shortly issued, in the same elegant style of execution that has characterized the previous volumes of this important survey of which it will form the sixth of the series. It covers a field hitherto scarcely explored, and Mr. Ridgway's three years of field work in the country between the Uintah Mts. and the Pacific Coast, leads us to expect, from the care and thoroughness that mark this author's previous works, a volume of extreme value to ornithological science.

At our request the author has kindly given us a summary of its contents, from which we learn that it will consist of three parts,—the first to be introductory, the second biographical, while the third will consist of a monograph of the North American *Raptores*. The introductory part will embrace a list, of the species

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* The Birds of Florida: containing Original Descriptions of upwards of Two Hundred and Fifty Species, with notes upon their habits, etc., by C. J. Maynard. With five plates drawn and colored from nature, by Helen S. Farley. Salem; Naturalists' Agency 1872. 12 pts. 4to.

of the adjoining provinces not met with during the Survey; a chapter on the "characteristic features of the Avifauna of the Great Basin," and on "the distribution of its local Avifaunæ." It will also treat of "geographical variation in color and proportions," of "hybridism" and of "certain so called 'individual' variations." Also a "systematic catalogue of the species obtained and observed during the progress of the survey" will be given, and a "comparison of the Avifauna of the Truckee Valley," in spring, summer and winter, with other matter of a similar character. The biographical section will contain an account of the habits, etc., of all the species observed (some 220 or more) with measurements of specimens and other notes. The Appendix, as previously stated, will be devoted to a monograph of the North American *Raptores*. This is a work that has engaged Mr. Ridgway's attention for several years, and in which we are promised a new classification of the *Falconidæ*, materially different from that and based almost wholly on osteological grounds. The generic and subgeneric characters will be illustrated by accurate outline figures, and the species of all the *Raptores* will be distinguished not only by full descriptions of all their known stages of plumage, but synoptically in tables, in which they will be compared with all their exotic allies.

The greater part of the work is said to be already in type, and we look forward to its publication with unusual interest.—J. A. A.

Prof. Snow's List of Kansas Birds.—For one, I wish to express, through the Naturalist, my obligations to Prof. Snow for his list of the Birds of Kansas, and to commend the principle upon which he has scrupulously acted — to mention no birds in regard to the occurrence of which in the state, he had not positive evidence. Such local lists, at least in my opinion, are only of value when thus made. I am glad to know that at least one compiler of a local list has been able to resist the besetting temptation to swell his catalogue by mere guess work, or by giving us a redundant list of birds that "probably will be" or "ought to be found" within the prescribed limits. So far as his list went, it was honest and reliable, and one that can be easily increased by addenda as occasion arises and the knowledge is given. But it has been my experience that the error of including species that never occur, is irretrievable. Swainson's warbler seems destined to figure forever as a bird of

Massachusetts with my name for the authority, and *Dendroica cærulea* and *Polioptila cærulea* are continually quoted for New England, without the slightest reason for so doing; and now that Prof. Snow has given us a reliable basis for an authentic list of the Birds of Kansas, I for one am not inclined to criticise that list because of species that escaped his knowledge, or because of a few misprinted asterisks, to mark as breeding in Kansas, birds that probably go farther north. We would only advise Prof. Snow when next he revises his list, to distinguish between the birds found in Kansas during the breeding season and those the nests of which have been positively found. This is often an important distinction, more so than would at first appear. Barren and unmated birds are occasionally found where they do not breed. —T. M. B.

In regard to the above, I wish to add a word or two. I agree with "T. M. B." that Prof. Snow has placed ornithologists under obligations by his "List of the Birds of Kansas," and especially since the additions he makes below, and the correction of typographical errors, etc., in the new edition I understand he is about to publish, will make it a correct exposition of the avian fauna of Kansas, as known at the present time. Professor Snow certainly avoided the "besetting temptation to swell his catalogue by mere guesswork" for through correspondence with him I have been gratified to learn that not a species was included except on good evidence, and that many of the apparent mistakes to which I called attention in the June number of the NATURALIST, in respect to species marked as breeding, were due to typographical errors. Having had considerable experience in the use of local lists, I may perhaps be pardoned for still persisting that if he had restricted his list to Eastern Kansas, or even to the birds actually observed in the vicinity of Lawrence, it would have been a far more useful contribution to geographical zoology. The fault of many lists, especially of those that are essentially merely nominal, is that they cover too much ground. Almost any of our larger states embrace portions of country very different in their climatic and faunal aspects, and it is hence quite insufficient to give merely the names of the species, without indicating whether they are accidental, occur only over limited areas, or uniformly over the whole area in question. My notice of Prof. Snow's paper being a conscientious review of its character as judged by its "internal evi-

dence,"—for I could not be expected to discriminate between typographical errors and those that were not,—I felt called upon to notice the omission of species that were among the most characteristic over half the area of the state; nor could I anticipate the speedy additions and emendations by which Prof. Snow's first brochure seems about to be transformed into as complete an exposition of the avian fauna of Kansas as our knowledge of the subject at present permits.

The above remarks are perhaps due to Prof. Snow; and it is likewise due to myself to state that if any unfairness of criticism or lack of appreciation on my part of the value of Prof. Snow's list is implied in the above remarks of "T. M. B.," I must beg leave to state that I fail to see the justness of any such implication.—J. A. A.

Since publishing my Catalogue of the Birds of Kansas, Mr. Allen's article in the May NATURALIST has appeared, containing 18 species not on my list, and he has also informed me of 4 others. Prof. Baird also has kindly gone through the Smithsonian collections and sent me 23 more species, represented there but not enumerated in my catalogue, and Mr. E. A. Popenoe of Topeka has added one other. This gives a total addition of 45 species, swelling the list to 284 *species* (or 282 *species*, if Nos. 9 and 10 and Nos. 12 and 13 are considered identical). The names contained in the following addenda* will be incorporated in a revised edition of the catalogue.—FRANK H. SNOW, *Lawrence, Kansas, May* 15.

* *Additions to the Catalogue of Birds of Kansas, communicated by J. A. Allen and S. F. Baird*:—3a, Hypotriorchis Richardsoni, Richardson's Merlin; Baird. 17a, Ictinia Mississippiensis, Mississippi Kite; Baird. 44a, Antrostomus Nuttallii, Poor-will; Allen, seen near Topeka. 45a, Chordeiles Henryi, Western Nighthawk; Allen, at Ft. Hays. 46a, Milvulus forficatus, Swallow-tail Flycatcher; Baird, seen at Ft. Riley. 60a, Turdus Pallasii, Hermit Thrush; Baird. 66a, Parula Americana, Blue Yellowback; Allen, near Leavenworth. 68a, Geothlypis Philadelphia; Allen. 70a, Helminthophaga pinus, Blue-winged Yellow Warbler; Allen. 70b, H. chrysoptera, Golden-winged Warbler; Baird. 70c, H. ruficapilla, Nashville Warbler; Allen, near Leavenworth. 74a, Seiurus Noveboracensis, Small-billed Water Thrush; Baird. 76a, Dendroica Blackburniæ, Allen. 76b, D. cærulea, Blue Warbler; Allen, near Leavenworth. 76d, D. cærulescens, Black throated Warbler; Baird. 76c, D. virens, Black-throated Green Warbler; Baird. 79a, Myiodioctes mitratus, Hooded Warbler; Allen, near Leavenworth. 81a*, Pyranga æstiva; Baird. 94a, Vireo Noveboracensis; Baird; Allen. 95a, V. solitarius; Baird. 103a, Troglodytes hyemalis, Winter Wren; Baird. 105a, Sitta Canadensis, Red-bellied Nuthatch; Baird. 118a, Plectrophanes pictus; Baird. 118b,* P. ornatus, Chestnut-collared Bunting; Allen, near Ft. Hayes. 118c, P. Maccownii, Maccown's Longspur; Allen, at Ft. Hays. 118d, P. melanomus; Baird. 132a,* Spizella pallida, Clay-colored Bunting; Allen, near Topeka. 135a, Peucæa Cassinii, Allen, near Ft. Hays. 140a,* Guiraca melanocephala, Black-headed Grosbeak; Allen, at Ft. Hays. 164a,* Pediœcetes phasianellus, Sharp-tailed Grouse; Allen, north of Ft. Hays. 177a,* Ægialitis moutanus,

BOTANY.

BOTANY FORTY YEARS AGO. — In a Washington book-stall, was found not long since, a copy of a book, probably now becoming rare. "Floræ Columbianæ Prodromus Exhibens Enumerationem Plantarum quæ hactenus Exploratæ sunt: or A Prodromus of The Flora Columbiana, Exhibiting a List of All the Plants, which have as yet been Collected. Compiled by John A. Brereton, M.D., U.S.A., Washington. Printed by Jonathan Elliot, and sold at his store on Pennsylvania Avenue, 1830."

The preface states that in 1825, was formed "The Botanic Club," consisting of Wm. Mechlin, Wm. Rich, Alex. McWilliams, M.D., John A. Brereton, M.D., and James W. Robbins, M.D., having for its object "to explore and to investigate, *de novo*, the indigenous plants growing in the District of Columbia.

As the result of five years' exploration, this Prodromus is published, giving a list of four hundred and thirty-eight genera with nine hundred and nineteen species, a large number for one locality. But again quoting from the preface, "The erudite Botanist will be astonished to perceive the names of several plants, in this Prodromus, which he is well aware, belong to other localities; but when he considers the various and alpine sources of our majestic Potomac, on whose stream their rudiments are borne, and deposited along its bank, his astonishment will cease." The plants are arranged according to the Linnæan System, while in an appendix is given "An Exposition of the Natural System of Jussieu."

This little work gives a pleasant picture of scientific interest and zeal, so long ago, and carries us back to the early days of American Botany. In the list of authors, we find no mention of the name of Dr. Gray (to-day it would be like the play of Hamlet with the part of Hamlet left out), but instead, Clayton, Walter, Michaux,

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Mountain Plover; Allen, western Kansas. 178a, Æ. melodus, Piping Plover; Baird. 178b, Squatarola helvetica, Black-bellied Plover; Baird. 185a, Tringa Americana, Red-backed Sandpiper; Allen, near Leavenworth. 186a, Actodromas Bairdii; Baird. 197a, Limosa Hudsonica; Baird. 198a, Numenius Hudsonicus; Baird. 198b, N. borealis, Esquimaux Curlew; Allen, a single specimen seen. 202a, Gallinula galeata; Baird. 207a, Bernicla Hutchinsii; Baird. 226a, Mergus serrator; Baird. 56a,* Empidonax acadicus, Green-crested Flycatcher; Allen, E. Kansas. 76e,* Dendroica discolor, Prairie Warbler; Allen, E. Kansas. 122a, Coturniculus Henslowii, Henslow's Bunting; Popenoe, Topeka. 201a, Porzana Jamaicensis, Little Black Rail, Allen, one specimen.

Rich, Pursh, Bigelow, Nuttall, Barton, Elliot, Torrey and Darlington, the latter of whom is spoken of as giving them his assistance, while a member of the House of Representatives.

Should such an example be imitated, and Natural History Societies spring up in every city or even village, not ambitiously seeking to accumulate large collections, but simply to make as complete as possible local collections of the fauna, flora, etc., of the vicinity, how many youthful naturalists might be trained, and what valuable additions might be made to our stock of knowledge respecting the inhabitants of our fields, woods and waters!

Another item of interest is found in this little book, "It would appear from recent observations, that some plants are *periodical* in their efflorescence; or from some unknown cause, disappear for several years at a time; for instance, *Orchis spectabilis* was found by members of the late Botanical Society, eight or ten years ago; and although the most diligent search has been made for it, for at least five years past, it has not been discovered until this season, when it is very abundant, and has been found in various parts of the District, by different individuals. I have also observed that *Arethusa bulbosa* is very abundant some years, and during others extremely rare. About five years since, *Batschia canescens*, was found in great abundance, near the Race-course, but has never been seen since."

The writer has had many similar experiences. In 1860, he found *Subularia aquatica*, growing very plentifully, on the muddy banks of a canal basin, near Portland, Me., but has never been able to find a trace of it since.

Cypripedium arietinum was found some years ago, in the vicinity of Portland, quite plentifully, by Dr. Wm. Wood. Several times during the next five years we visited the locality, but found not a plant, till 1869, when we gathered some twenty specimens.

Again, the writer botanized in the vicinity of Seneca Lake, in company with Prof. Wm. H. Brewer of Yale College, one or the other of us, going over the ground quite thoroughly for seven summers, and collecting over seven hundred species.

During these seven years, many species appeared, disappeared, and reappeared, without apparent cause, and without perceptible change in the climatic or other conditions. Among these, were *Ranunculus Purshii*, *Aplectrum hyemale*, *Orchis spectabilis*, *Pterospora andromedea*, and others not now remembered.

Probably every careful botanist would be able to relate similar experiences.— J. W. Chickering, Jr. *Washington.*

Moosewood Fibre.— At a recent meeting of the California Academy of Sciences, Dr. A. Kellogg presented specimens of the bark of a shrub *Dirca palustris* (Moosewood) of stronger fibre than any hitherto known, obtainable in this vicinity by tons and in the valley of the Mississippi by millions of tons.

The bark presented was in the crude condition as it came from the Ramie machine. The entire shrub, wood and bark, is suitable to work into fine quality of paper.

If desirable to separate the bark, it is done in the easiest manner possible. On the State University grounds may be seen a tree four and one-half to five inches in diameter. Mixed with silk the fibre is superior to Ramie. Even for coarse fabrics it may prove a substitute for jute, of which a very large amount is annually imported into the Southern States for baling cotton. The tree is familiar to us as Moosewood, but has not heretofore been brought forward, so far as we are aware, as material for paper.

Obione Suckleyana Torrey.—In our Colorado collections last year we find this plant, perhaps the first time gathered so far north.— Thomas Meehan.

Botanical Notabilia.—E. A. Thompson of North Woburn announces a wild double-flowered state of *Saxifraga Virginiensis.* We have heard of this in only one instance before. Rev. N. Coleman finds at Grand Rapids, Michigan, a *Trillium grandiflorum* "with six sepals and fifteen petals, all green." This *chlorosis* monstrosity occurs occasionally, but we have never seen so many floral leaves. Also *Ranunculus Purshii* with leaves all dissected although the plants were strictly terrestrial, rooted in merely moist ground.

Correction.—In my remarks, in the last number, on *Quercus alba* var. *Gunnisonii*, I wrote, " some of the trees have the bark of *Q. alba*," not *none* of the trees, as was printed.—Thos. Meehan.

ZOOLOGY.

The Gregarious Rat of Texas (*Sigmodon Berlandierii*).— This is a burrowing, gregarious rat, and like the Prairie dog lives

in towns on the prairie. They dwell together in families. They prefer light sandy soil on the prairie, where the shivered limy sandstone crops out, but when the prairie is enclosed and cultivated, they take possession of the fencing, and burrowing under the bottom rail, excavate sufficient cells and construct their copious grassy beds there. Out on the prairie, in the wild state, they make one principal burrow, in front of which they pile up the earth that comes from all their subterranean galleries. They rarely extend their main burrow more than eight or nine inches in depth, while their underground passages are seldom more than four or five inches below the surface. They also construct several secret outlets, opening ten or twelve inches from the main hole, which opening they very ingeniously conceal by strewing a few grass blades over it; and so, when the rat hunter attacks the citadel the inmates escape through some of the concealed passages. Eight or nine inches deep and turned a little to one side in the main hole, is a cavity seven or eight inches in diameter, filled with fine, soft grass blades, which must be quite warm and pleasant, serving the family for winter quarters. During the hot months, they construct nice grass beds in a basinlike cavity, which they dig out, under the sides of large tufts of grass, or little heaps of brush. The above is about the average customs of the distinct families in reference to the manner of making their homes, and in the same district, in suitable soil, they construct many such family residences, and cut out very nice, clean roads from one to another in all directions. The grass, weeds, dewberry briers and everything in the way, are cut out and carried away leaving the road about two inches wide, underrunning the grass and other rank growths that may fall in the way. I have traced some of these roads fifty or sixty yards, upon which there had been so much labor expended that it could not have been the result of individual enterprise. These roads, which bear the indications of much travel, are evidently the results of a unanimous governmental effort. They are found universally in their cities, and passing from house to house there are many cross roads.

This Rat has a large thick head, nothing remarkable about the mouth and nose, eyes full, black and lustrous, ears half of an inch high and nearly circular; neck very short, body short and large; tail three and three-fourths inches long, clothed with very short, thick set hair; feet with five toes, nails strong. No cheek pouches;

no grooves about the incisors, not very long hairs or "smellers" on the nose. Coloration a brownish gray. — G. Lincecum, *Long Point, Texas.— Communicated by the Smithsonian Institution.*

Notes on Cemiostoma. — I desire to correct a statement made by Mr. Mann in the June number of the Naturalist, p. 339, viz., that *Cemiostoma coffeellum* is "the only species of *Cemiostoma* which is known outside of the limits of Europe."

This is a mistake. In the "Transactions of the London Entomological Society," Ser. 2, Vol. v, pp. 21 and 27, and in Ser. 3, Vol. ii, p. 101, certainly two, and if my memory is not at fault, three species, are described from India, and in Vol. iii, p. 23, of the "Canadian Entomologist," I have described a species, as *C. albella*, which I had then found mining the leaves of poplar trees (*Populus alba*, *P. dilatata* and *P. monilifera*). Since then I have found it also mining the leaves of willows (*Salix alba* and *S. Babylonica*). It resembles *C. susinella* very closely and as *Susinella* mines the leaves of *P. tremuloides* in Europe, I shall not be surprised if it proves to be that species. It would be difficult, if not impossible, now to ascertain the original food plant of *C. susinella* (if *albella* is identical with it). But it would not be very surprising if it fed on the weeping willow, and has followed its migrations from a time perhaps anterior to that when the Hebrews hung their harps upon the willows by the rivers of Babylon.

If therefore *C. albella* is only a synonyme of *C. susinella*, it is a European or Asiatic species. And judging from the food plant, *C. coffeellum* is also an Asiatic (or African?) species. It would thus seem that we have as yet no indigenous species of *Cemiostoma*.

Mr. Stainton, Dr. Clemens and others, mention a "spring brood," a "fall brood," etc., of *Microlepidoptera*. At page 184 of Vol. iii, Can. Ent., I have stated as the result of my observations that the *Lithocalletidæ* (in which family I would include *Lithocalletis*, *Leucanthiza*, *Philocnistis*, *Cemiostoma*, *Tischeria*, and perhaps *Lyonetia*) continue to propagate their species as long as the weather remains warm enough: so that the number of generations in a year is (subject to the length of time passed by each species as larva, pupa and imago) a mere question of climate, and that the different generations overlap each other so that there is no such thing as separating them into distinct broods. This is likewise true of some species of *Gracillaria*. I do not know how it is

as to *Lyonetia* of which we have but one species described by Dr. Clemens from a single captured imago. But I am glad to see that Mr. Mann's observations as to the number of broods of *C. coffeellum*, confirm mine as to the *Lithocalletidæ* generally.

Mr. Mann writes the termination of the specific names of the *Tineina*, *ellum* instead of *ella*. As a matter of grammatical purity this may be well enough, but the termination *ella* has been so universally adopted, and in use so long that it is too late now to change it, and as a matter of convenience it had better be retained. —V. T. C., *Covington*, *Ky*.

THE RATTLE OF THE RATTLESNAKE.—Being interested in the controversy now in progress in the pages of the NATURALIST relative to the use of the caudal appendage of the rattlesnake, and knowing that all the facts concerning it must be duly considered before any definite conclusion can be arrived at, I have presumed to proffer my mite and suggest some inquiries, the consideration of which may throw some light on the subject.

All movements of the animal are accompanied by the peculiar sound; at least, such is my observation and I have had ample opportunities for observing. The more forcible or vigorous the movement the louder the rattle. When moving through tall stiff grass the sound emitted is much louder than when the movements are not so retarded. This peculiarity I noticed two years ago when on the frontier in this state. One day while sitting in the door of my tent, a large rattlesnake appeared on the *tramped ground* in front. He seemed to be moving "leisurely" across, his movements being attended with a "gentle" rattle. After watching him about two-thirds the way across the tramped ground, I started toward him, when he increased his speed and the rattling sound correspondingly increased in frequency and character.

Inquiry A. Is the rattling produced by vital or mechanical means? The increased rattling when the movements are retarded would seem to indicate the latter. The rattle of the dead animal when moved, emits the same peculiar sound, or shaking the rattle in the closed hand is attended with a like result, the sound being somewhat muffled in character, dependent upon being conveyed through the hand. The greater the number of segments in the rattle the greater the sound; the larger ones emitting the louder sound but being of a lesser pitch than the smaller ones.

Inquiry B. Does the fact of the increase of the number of segments with the age of the animal militate or substantiate the theory of "Natural Selection" as applied to the phenomena? The older the animal the louder the rattle. It seems to me that this fact tends to disprove the mimetic claim of Prof. Shaler and the "self-protective" feature of Mr. Henderson. Both of these features, Mimicry and Protection, may be included, but neither, nor both combined, will account for the whole of the phenomena, in relation to this fact—the young requiring greater facilities for obtaining food and more extensive measures for protection. — T. W. DEERING, *Leavenworth*, *Kansas*.

VENOMOUS FISH.—It is generally known that the wounds inflicted by the weevers (*Trachinus*) of our coasts, and by the sting-rays, are rendered poisonous by a mucous excretion adhering to the spines of the head, back, and tail of these fishes; and a most perfect poison-organ, analogous to the poison-fang of snakes, was described some years ago by Dr. Günther in two fishes (*Thalassophryne*) from Central America. Dr. Le Juge has found at the Mauritius another still more dangerous kind of venomous fish; it was long known to ichthyologists under the name of *Synanceia verrucosa*, and is readily recognized by its monstrous appearance, the head being deeply pitted, and the body scaleless and covered with warts. It is by no means scarce, being found throughout the Indian Ocean, and known at the Mauritius as the "Laffe." There are thirteen spines in the dorsal fin, each provided at its base with a bag containing the poison, and with a pair of deep grooves along which the poison is guided to the wound. As in all the other fishes of this kind, the poison-apparatus is merely a weapon of defence, and comes into action when the fish is seized or trodden upon. The action of fish-poison upon the human organism appears to be less rapid than that of snakes; though patients who neglect to apply remedies similar to those used for snake-bites expose themselves to serious consequences, which may terminate even fatally. In one case a fisherman died on the third day from a severe wound. Dr. Le Juge mentions that the fishermen of Mauritius successfully apply poultices of the leaves of a composite plant, *Microrhynchus sarmentosus*. (*Transact. R. Soc. of Arts and Sciences of Mauritius*, 1871.)—*Academy*.

VITALITY OF REPTILES.—I wish to draw your attention to some experiments by the Rev. William Buckland, as well on account of

their interest as to prevent their needless repetition. I do not recollect where I found the account of them, but I give the substance from memory. Twelve frogs were carefully weighed and placed in holes drilled in limestone, and the holes were covered with glass lids, cemented with clay, and the glass protected by slate, also cemented with clay. Twelve were treated in the same way in a block of compact sandstone, and another lot were placed in holes drilled in the trunks of trees. At the end of a year they were examined. Those in the wood were dead and partly decayed, as were those in the sandstone. About half of those in limestone were living and of these all but two had lost weight; and two had increased in weight. The cement closing the cell of one of these was cracked so that small insects may have found their way into it, and served as food; and although no crack could be found in the cell of the second it was probably fed in the same way, as in a third cell, also without any discoverable crack, in which the frog was dead, several small insects were found. The living frogs were closed up again, and at the end of the second year, all were dead. The frogs were examined frequently, during their confinement, by removing the slate without disturbing the glass, and in all cases the living ones were found not torpid, but awake and active. —W. K. Brooks, *Suspension Bridge, N. Y.*

Change of Temperature in Water Containing Recently Fertilized Shad Eggs.—In the September number of the Naturalist, 1871, the question was asked, "Can any one give us an explanation of the *fact* " that, as reported by A. S. Collins, when shad eggs swell after impregnation, the water in the pan becomes about 10° colder?" Such a fact requires, of course, careful and repeated observation to establish it. But, in connection with it, the following (from "Nature," January 18, 1872) has some interest. At the Academy of Sciences, Paris, January 2d, "a note on the heat absorbed during incubation, by M. A. Moitessier, was communicated by M. Balard. The author finds that the specific heat of fecundated is less than that of unfecundated eggs when treated in the same manner, and infers that a portion of the heat absorbed by the former during incubation is transformed."

According to the recognized use of the term "specific heat," it is obvious that this statement should have been, that the specific heat of fecundated eggs is *greater* than that of unfecundated ones; as heat is said to be *absorbed* by the former. The trans-

formation, however, which is referred to, is exactly what occurred, to the mind of the writer, upon reading the item concerning shad eggs; but he was diffident about expressing it, until meeting with the above confirmation, both of the fact and of the explanation. There are few cases more satisfactory, in favor of the correlation between life-force (growth-force, bioplastic force) and the other physical forces, than heat. — H. HARTSHORNE, *Philadelphia.*

ANOTHER NOTE ON THE SAME.—My idea is that germination in the seed of plants requires heat, so does the impregnation of the eggs named. Hence the absorption, so to speak, of the heat from the water. We all know that conception in the animal requires heat, making the conclusion above obvious. — N. COLEMAN, *Otsego, Michigan.*

NEST AND EGGS OF HELMINTHOPHAGA LUCIÆ. — This interesting little bird was discovered in Arizona, and first described, by Dr. Cooper (Proc. Cal. Acad. 1862, 11, 120) and afterward written about by the same gentleman (B. of Cal. 84), by Baird (Rev. 178) and by ourselves (Ibis, 1866, 260; Proc. Phila. Acad. 1866, 70); this is its record, up to date, the nest and eggs remaining unknown. Lieut. Charles Bendire, U.S.A., writing to us from his camp near Tucson, Arizona, May 19, 1872, says: "I found to-day the nest of a very small warbler, four inches long, which has a bright chestnut spot on the crown, and the tail coverts of the same color, the other upper parts cinereous, the lower parts dull white. I cannot find it in Baird's work. The eggs, four in number, are nearly globular in shape, and hardly larger than those of a hummingbird, white, with fine red spots on the larger end. I am afraid I shall be unable to save them, as they contain large embryos. The nest was placed between the bark and main wood of a dead mezquite tree, about four feet from the ground." — ELLIOTT COUES.

OCCURRENCE OF COUCH'S FLYCATCHER IN THE UNITED STATES. The same valued correspondent speaks of finding this bird near Tucson; it has not, I believe, been hitherto taken north of Mexico. It is a slight northerly variety of the *Tyrannus melancholicus*, a species of wide distribution in Central and South America. — ELLIOTT COUES.

THE FOOD OF THE BLACK BEAR.— A few days ago I secured

for the museum of this college a fine specimen of the Black Bear (*Ursus Americanus*) caught in the neighboring town of Pownal, Vermont. In his stomach there was not, apparently, a particle of animal food, but that organ was well filled with vegetable substances, the stalks and corms of the Indian Turnip (*Arisœma triphyllum*) being among the most abundant. The bear was very fat, but whether his excellent condition was brought about wholly by vegetable food is not known. — SANBORN TENNEY, *Williams College, June* 12, 1872.

A NEW LOCALITY FOR *Zonites cellarius* Müller. Living specimens of this imported species were received by me, last fall, from Mr. Samuel Powel, of Newport, R. I. They were found by Mr. David Coggeshall in his cellar. As is well known, the species has already been detected in almost every seaport, from New York to Halifax. — W. G. BINNEY.

THE BLIND CRAYFISH.— In the last number of the NATURALIST, p. 410, Prof. Cope proposes the genus Orconectes for the *Cambarus pellucidus* of the Mammoth Cave and his supposed new species from the Wyandotte Cave, "on account of the absence of visual organs," and states that "Dr. Hagen's view [in regarding the species as a Cambarus] may be the result of the objections which formerly prevailed against distinguishing either species or genera whose characters might be suspected of having been derived from others by modification, or assumed in descent. The prevailing views in favor of evolution will remove this objection."

My objection to the separation of *Cambarus pellucidus* from the other species of the genus simply because the eyes were rudimentary, was based on the fact that there are known cave insects, as for instance the genus *Machaerites* with seven species, in which the *females are blind*, while the *males have well developed eyes.* I did not mention the fact in my monograph because its discovery was nearly ten years old, often mentioned and well known by those who have studied the cave insects.

Would Prof. Cope have the cruelty to separate husband and wife so far as to put them in different genera because one of them is blind and the other not? If the prevailing views in favor of evolution demand such a separation, would it not be more human, and perhaps more courteous to the feminine sex, to wait a little while until the poor males shall be able to follow their more

advanced wives? It is rather hard for Nature to follow, or even compete, with the fast driving of the evolutionary disciples, but as she is after all a very good natured old lady I have no doubt she will do her best not to stay too far behind the prevailing views of evolution.

Concerning the new species, "*O. inermis*," the description of the single specimen does not give any character by which to separate it from the old species, *C. pellucidus*. I have not seen Prof. Cope's type, and, though he states that his specimen is a male, he omits to inform us to which of the two forms of males it belongs, but his description applies perhaps to the second form of the male, the characters of which are always less marked than in the first.—Dr. H. Hagen.

GEOLOGY.

New and Remarkable Fossils.— We copy from the "College Courant" the following summary of the latest published results of Prof. Marsh's expeditions to the West;—The extensive collection of fossil vertebrate remains which were made in the West by the Yale expeditions of 1870 and 1871, are yielding, in the hands of Professor Marsh, results of the greatest value to palæontological science. Ten important papers upon the new material thus obtained have already been contributed by "this indefatigable palæontologist" to the "American Journal of Science," the last three of which relate exclusively to the collections of 1871. The first of these later papers, published in April, contains a description of some Pterosaurian remains, additional to those discovered by the expedition of 1870, of which an account was published about a year ago. To the gigantic species of pterodactyl then obtained, Professor Marsh gave the name *Pterodactylus occidentalis*. The expedition of 1871, in exploring the original locality in Western Kansas, not only obtained further portions of the same skeleton, but secured other specimens which prove the existence of two other gigantic pterodactyls during the later Cretaceous. The characters of *Pterodactylus occidentalis* are derived from the study of portions of five individuals. They show clearly that the species belongs to the short-tailed or true Pterodactyls, and that it contains some of the largest "flying dragons" yet discovered, the spread of wing in these individuals

being from eighteen to twenty feet! Its large tearing teeth clearly indicate the carnivorous and predaceous habits of the species, and its food was doubtless fishes which it captured, probably by plunging into the water like the pelicans and other similar birds. Two new species, *P. ingens* and *P. velox*, are also described in the same paper. The former was even more gigantic than the one just mentioned, being at least double its bulk and measuring from tip to tip of the expanded wings fully twenty-two feet! *P. velox* was about two-thirds this size, having a spread of wing of from twelve to fifteen feet. The great interest attaching to these fossils lies in the fact that, up to the time of their discovery, no remains of these flying Saurians had been detected in this country, although they are found abundantly in the Cretaceous of Europe.

In the same number, Professor Marsh announces that the Mosasauroid reptiles were protected by osseous dermal plates. Specimens belonging to the genera *Edestosaurus*, *Liodon*, *Holcodus* and *Clidastes* have been obtained with these plates attached. These dermal "scutes," as they are termed, are quadrilateral in form, with the margin of the upper side more or less bevelled, so as to admit an imbricate arrangement; alternate rows of different sizes and shapes thus producing a complex pattern. The cranium was probably not thus protected.

In the May "Journal of Science" Professor Marsh describes the remarkable gigantic swimming bird, discovered in Western Kansas, to which he gives the name *Hesperornis regalis*. The skeletons of five individuals of this species, more or less complete, were obtained. From these, it appears that while Hesperornis differs widely from all known birds, recent or extinct, it has its nearest living allies in the Colymbidæ, or divers. The skeleton complete, would measure about five feet nine inches from the apex of the bill to the extremity of the toes. The extreme rarity of birds in the Cretaceous formation, even of any kind, renders this discovery of great importance. But it is especially so, when it is remembered that all the birds hitherto discovered, either in the Cretaceous of this country or of Europe, are of comparatively small size, and belong to still existing families; such as the swan-like bird (*Laornis*), the wading birds (*Paleotringa*), the rails (*Telmatornis*), and the cormorants, (*Graculavus*), which Professor Marsh has already described from the American Cretaceous.

But the most valuable of Professor Marsh's papers is the last, which appears in the "Journal of Science" for June. It is a review of the "Structure of the Skull and Limbs in Mosasauroid reptiles," made possible only by the richness of the Yale Museum in the remains of these remarkable animals. Though this paper is almost entirely a technical one, yet the results are obviously of high scientific interest. Prof. Marsh shows that the quadrate bone of the skull as given by Professor Cope should be reversed, by finding a skull of *Lestosaurus* with this bone in position. Moreover, his explorations have discovered the stapes, the columella, the quadratoparietal arch, the malar arch and the pterotic bone, belonging to the cranium; and have proved the exact character of the anterior limbs and the presence of posterior limbs in these reptiles. They also show that the neck in the Mosasaurus group was unusually short. Two new genera, *Lestosaurus* and *Rhinosaurus*, are described; under the former, four new species are included. *Rhinosaurus micromus* Marsh and *Edestosaurus rex* Marsh, are also here described. The paper is illustrated by four admirable lithographic plates.

MICROSCOPY.

CELLS FOR MOUNTING OBJECTS.—A recent discussion on this subject at the Queckett Microscopical Club in London, developed several important suggestions.

Lead cells. Mr. James Smith introduced the subject by a paper "On Cell Mounting." He used cells of sheet lead; flattening the sheet on a plate of glass by rubbing with an ivory paper knife, and cutting or punching cells which were subsequently flattened by pressure between two ordinary glass slides. Dr. Matthews suggested flattening the lead upon a plate of glass, by rolling, and cross rolling, with a piece of barometer tube. The Chairman, Henry Lee, Esq., remarked that Dr. Bowerbank had for years used exclusively tea lead for his smaller cells and common plumbers' lead for his larger cells: all his large collection of sponges were successfully mounted in this way. The secretary, Mr. T. C. White, had been in the habit for many years of using cells of thin sheets known as "pattern lead" used by dentists; the cells being easily stuck on with marine glue, and not melting if the slide should be made nearly red-hot.

Tin cells. Mr. Richards had used cells of rather thin tin foil, cut out with two punches with a piece of tube between to keep them the right distance apart: these cells were fastened on by a solution of glue and treacle dried on and then moistened enough to stick them, the cells being so thin that any liquid cement would have run in. The chairman commended the tin cells introduced by Mr. Suffolk; he having used them, fastening them on with marine glue with great satisfaction: Dr. Matthews, however, objected to them because they melt so easily if the slide be overheated.

Zinc cells and *vulcanite cells* were favorably mentioned by Mr. White, the former bearing great heat without melting, and the latter resisting the action of acids: but Mr. McIntire found they had a tendency to chip off.

[The expensiveness of glass cells, when used in large quantities, is the continual occasion of a demand for some good substitute. Tin cells are largely used in this country, being often fastened on by gold size whose only fault is that it dries so slowly that the cells require to be fastened on long before using, or with dammar varnish or Bell's cement. Doubtless the lead cells will hereafter be used by many who desire to preserve a great many specimens but cannot afford to spend unnecessarily on an elegant mounting. It would seem that some of the dealers might prepare and sell them at a price that would be remunerative to themselves, and at the same time an accommodation to buyers.]

THE COMMON PARABOLOID AS AN IMMERSION INSTRUMENT.—Notwithstanding the introduction into use of special contrivances as immersion paraboloids, it may not have occurred to all who use the microscope that the ordinary form of parabolic illuminator is capable of being used wet with excellent results. Placing the microscope in a vertical position, and greasing the rod in the centre of the paraboloid to keep the water from running out by the side of it, the cup of the paraboloid is filled with water heaped up as far as can be without running over, and then brought up until the water comes in contact with the under surface of the slide. The direction of the rays leaving the paraboloid is not altered by this arrangement, but dispersion at two surfaces is avoided and the rays enter the object slide without the usual refraction and at such an angle as to suffer total internal reflection before reaching

the objective. With the highest objectives generally used with black ground illumination, as a $\frac{1}{4}$th of 75° to 110°, the object seems no brighter than usual, but the field is free from the foggy diffuse light, otherwise present, and the object appears, beautifully distinct, upon a jet black ground. Even a $\frac{1}{5}$th or $\frac{1}{8}$th of 130° gives the same effect of a deep black background, and shows the object with good stereoscopic effect in Wenham's binocular. With objectives of 170°, the main effect is that of a dark background, though not so perfect as with the lower angles.—T. D. B.

Bichromatic Vision.—Mr. J. W. Stephenson, inventor of the recent binocular microscope which bears his name, has noticed that if different colors are presented, simultaneously, to the two eyes, the sensation produced will be that of neither of the two colors, but of one which would be produced by mixing them together. If the colors presented are strictly complementary, the effect will be that of common white light; as the two bright colored disks produced in the field of a microscope by a double image prism and a selenite plate, become white where they overlap. The effect is best studied with the binocular microscope and polariscope. A plate of selenite is introduced so as to give both fields of a bright conspicuous color; and then a film of mica is interposed in the course of the rays supplying one tube, of such thickness and position as to give, by retardation, a color as nearly as possible complementary to the first. One field, for instance, may be a bright red, and the other a bright green, while the observer, viewing both at once, will see only a colorless field. By an ingenious changing of the plates by which the colors are produced, both fields may be gradually changed to totally different colors, the complementary character being maintained throughout the change, without any knowledge of the change on the part of the observer. If the color of one field is entirely removed, the observer becomes slowly and feebly conscious of the color of the other. The optical and physiological bearings of this discovery are obvious and interesting.

New Arrangement of Spring Clips.—Miller Bros., of 1223 Broadway, N. Y., are manufacturing a contrivance which must be, for certain purposes, a very convenient substitute for Dr. Maddox's spring clips. It consists essentially of a mahogany strip, of suitable size, grooved upon its upper surface and protected with

pins in such manner that a dozen slides can lie, side by side, securely upon it. An equal number of thin brass wires spring from one side of the block, and are bent down so that they can be easily made to press upon the centres of the covers, to hold them in position while the balsam or other mounting material is hardening. Little cork disks are furnished to place upon the covers and beneath the springs. For some uses the corks would doubtless be dispensed with, and when needed they would probably be more convenient if attached to the wires by passing the wires through them. An additional groove should be cut in the wood under one end of the glass slides to facilitate the removal of one slide without disturbing the others.

Single Front Objectives.—Mr. Wenham believes that the principal use of the late discussion upon the working angular aperture of immersion objectives viewing balsam-mounted objects, which angle he still maintains is necessarily limited to 82°, although Mr. Tolles cannot see the difficulty of its exceeding that figure, consists in the dissemination of the information that the best American objectives, both dry and immersion, are now made with single fronts. As the originator of this style of construction, though having at the time no knowledge of its importance nor expectation of the success it has since attained, he naturally feels an undisguised interest in its success. The triple-front objectives he considers already obsolete.

Microscopy at the American Medical Association.— During the Philadelphia meeting of this society, this summer, an evening reception was given at the Academy of Natural Sciences, at which music and sociability were supplemented by the entertainment afforded by microscopic specimens. One hundred microscopes were used, and novel accessories exhibited.

Structure of Diatoms.—Prof. Adolf Weiss, of Lemberg, has published some researches upon this well-studied but still obscure subject. He regards the silicious envelope as capable of polarizing light, and as consisting of a cellulose coat more or less infiltrated with silex. He does not consider the individuals one-celled, but finds the valves composed of cells from .008 to .00025 mm. in diameter. These cells are furnished at their centres with papillæ which appear as striæ under low powers and as moniliform mark-

ings under high powers. The large cavity between the frustules is regarded as equivalent to the embryo-sac of higher plants, and the formation of new individuals has been observed within it. An alternation of generation is indicated by the observations made.

Origin of Cancerous Deposits.— Dr. J. J. Woodward discusses this question in a report to the Surgeon General. His observations of structure do not differ materially from those of other recent observers, though the cell walls of the cancer cylinders, described by Kœster, he is able to detect in only a portion of the cases. He reviews the theory of Kœster who regards the nucleated cylinders as transformed lymphatics, and of Thiersch who explains them as outgrowths from the lower layer of the epidermis and from the epithelium of the glandular apparatus. The latter view was originally applied to epithelial cancer, but has been extended by Billroth to cancer generally. Dr. Woodward is manifestly unwilling to commit himself to any theory, but rather favors Kœster's on account of the well known similarity of the morbid growths when affecting different organs, and on account of the manner in which the cell cylinders anastomose, which points rather to the lymphatics than to the gland tissue. He seems not unwilling to regard the cancer cylinders as consisting of transformed white corpuscles accumulated in the lymphatic passages. The presence or absence of a cell wall he justly considers unimportant, it being only an indication of age in cells which, according to our present knowledge, consist originally of only a nucleus embedded in a mass of protoplasm.

The "Nerve" of the Tooth.— Mr. T. C. White has read a very interesting paper on this subject before the Queckett Microscopical Club. Though considering it a painful subject, and not to be touched upon except very lightly, he nevertheless considers it interesting to know something of its structure and uses.

The pulp, or so called nerve of a tooth, should be obtained from a tooth of the temporary set removed in a state of health to make room for the advancing permanent set. A longitudinal groove is to be filed around the tooth, which is then to be very carefully washed, and then split with a pair of wire nippers. The pulp will thus be fully exposed, and may be stained by soaking for twenty-four hours in an ammoniacal carmine solution as recom-

mended by Mr. Beale, washed, soaked in glycerine for a few hours, and finally flattened by gentle pressure in a compressorium for a few hours more until it is sufficiently thin to be examined by a $\frac{1}{4}$th inch objective. It is also advised to soak an entire tooth for a few weeks in the carmine staining fluid, then decalcify it by immersion in hydrochloric acid, and cut thin slices through the whole which will show the pulp and decalcified osseous tissue in their natural relation to each other.

Thus studied, the "nerve" appears to be a mass of areolar or connective tissue, through which ramify the nerve, vein, and artery. It not only constitutes a very delicate sensory organ, but originally was the means of building up the dentine; and even in adult life performs an important part in sustaining the vitality of the tooth, and is capable under certain stimulating influences of developing dentine again. [The unsatisfactory nature of a tooth whose "nerve" has been "killed" would seem to be confirmed and explained by these views of its functions.]

Misnaming Objectives.—[Although the controversial part of this question has occupied too much time already, we publish the following note from Mr. Stodder who seems entitled to an opportunity to correct the idea that his having previously written over initials implied an unwillingness to assume full responsibility for his statement. The editors of this Journal are not responsible for anything credited either by name or initials to any other authority.—Eds.] The brief remarks of mine, printed over the initials C. S. in the March number of this Journal, were copied essentially in the "Monthly Microscopical Journal" for April. In the May number of that periodical Mr. Wenham writes a reply. It is a remarkable paper not only from the eminence of the writer, as an authority on microscopy, but from his evident loss of temper and by the terms to which he refers to Mr. Bicknell and to C. S. Under these circumstances I must ask for a little space for a rejoinder to my share; I have nothing to say for Mr. Bicknell as he is able to take care of himself.

Mr. Wenham commences his paper which *he calls* a "reply" with this,—"to correct a misstatement that I [Mr. W.] wrote a paper in reply to one of Mr. Bicknell's; I did not commit myself to such an extent." This is a mere quibble, unworthy of its author. The very caption of the paper had Mr. Bicknell's name

in it. I should not have noticed this, had not Mr. W. unfairly, as I think, charged me with a misstatement.

Next, Mr. Wenham couples C. S. and Mr. Bicknell together as if they acted in concert, and were joint writers. I can assure Mr. Wenham that it is not so. Mr. B. is not responsible for any thing I have written, nor am I for him. Neither had seen the other's writing until it was public.

Next, I have no "plea or atonement" to make "for expressions hastily or inconsiderately written." My expressions were used deliberately and after full consideration of their import. I still hold the same opinion, namely, that selling an objective by a name that does not *approximately* indicate its focus (*i. e.* $\frac{1}{5}$ for $\frac{1}{4}$, $\frac{1}{20}$ for $\frac{1}{16}$ or, as I have known, $\frac{1}{20}$ for $\frac{1}{40}$, as in the case of an eminent French maker; or, as in another instance, a $\frac{1}{18}$ for a $\frac{1}{30}$; or, as in the case of an English objective that I have recently heard of, a $\frac{1}{20}$ for a $\frac{1}{8}$) is an "imposition," or a fraud if that term is preferred, not applying it, however, as Mr. Wenham represents, to a particular firm, but to all, of any country, who practise such "imposition;" and that Mr. Wenham in his paper, by stating that "$\frac{1}{8}$ths were $\frac{1}{9}$ths or $\frac{1}{10}$ths, and some now approach $\frac{1}{12}$ths in power," without disapproval, was practically defending the custom, and *that* he does not now deny. His paper in reply to Mr. Bicknell was published in December. In May he writes, "no one knows better than myself the difficulty of adopting a nomenclature that shall exactly denote the power of all the highest object glasses sent out"—something has evidently produced some effect on him since that time. The complaint was not of want of "exactness," but of gross misnamers of twenty or fifty per cent., such as he named in the December paper, not in regard to the highest powers alone but applicable to the lowest powers as well. Such was what I called an imposition, and I call it so now.

In the "Quarterly Journal of Microscopical Science," October 1862, Capt. Mitchell gives the measurement of the focus of several London objectives; most of them being undernamed. Capt. M. complains of this; he says "when I buy a $\frac{1}{4}$th, I want a $\frac{1}{4}$th, not something else." He calls those correctly named, *honest;* by implication, those not so named, dishonest.

Dr. Wm. B. Carpenter ("The Microscope," fourth ed., 1868, p. 184) says, "the designations given by the opticians to their objectives are often far from representing their focal length, as estimated by that of single lenses of equivalent magnifying power, a

temptation to *underrate* them being afforded by the consideration that if an objective of a certain focus will show a test object as well as another of higher focus, the former is to be preferred. Thus it happens that what are sold as $\frac{1}{2}$ inch objectives are often more nearly $\frac{4}{10}$, and that what are sold as $\frac{1}{4}$ are not unfrequently more nearly $\frac{1}{5}$." I presume that I am justified in assuming that Mr. Wenham was fully aware of both the above, that Capt. Mitchell termed the custom dishonest in 1862, and Dr. Carpenter that it was the result of "temptation" in 1868, yet he did not feel called on to "practically defend" the want of honesty, or the yielding to temptation. Was he not then as now "a witness in behalf" of those *he* calls the "most respectable portion of the body?" Was it only censure from this side of the Atlantic that was "worth caring for?" It certainly looks so.

For some twenty years I have watched Mr. Wenham's contributions to microscopy. I have used and admired his ingenious inventions and appliances and have looked upon him as one of the foremost leaders and authorities in the mechanical and theoretic departments of the science. It was with regret that I saw that he did not disapprove of the fictitious nomenclature. It is with greater regret that I find that he has in his haste used the arrogant expressions that he has.

The question of nomenclature is now being agitated, the attention of microscopists is attracted to it, and one consequence will be that the "honest" makers will be appreciated.— CHARLES STODDER, *Boston*, *May 27th*.

NOMENCLATURE OF OBJECTIVES. — Dr. J. J. Woodward's paper on this subject in the June number of the "American Journal of Science and Arts," goes over a considerable part of the same ground as Dr. Ward's paper published in the NATURALIST three months before; though that paper had not been read by Dr. Woodward at the time of writing the principal part of his article. Both authors are laboring for the same result, uniformity, though with some important minor differences of which we shall speak at another time. Both have proposed the naming of objectives by their amplifying powers; but it is greatly to be desired that no one shall adopt such a plan until some distance of measurement can be agreed upon by all. We have enough individual differences to reconcile already.

NOTES.

A MEETING of the Chicago Academy of Sciences was held on June 11th, in honor of the memory of its late Trustee, Director of its Museum, and Secretary, Dr. William Stimpson. A sketch of the life of Dr. Stimpson was given by President Foster. Letters were read from Prof. Joseph Henry, Mr. George C. Walker and others, and remarks were made by members of the Academy, bearing witness to the great and faithful labors of Dr. Stimpson in the cause of science and in the work of the Academy. Mr. E. W. Blatchford offered a series of resolutions in honor of the memory of Dr. Stimpson and providing for the publication, in the Transactions of the Academy, of a Memoir on his life, and the entering of the following tablet on the records:

IN MEMORIAM

WILLIAM STIMPSON, M.D.,

BORN FEBRUARY 14TH, 1832;

DIED MAY 26TH, 1872.

At a meeting of the Essex Institute held on June 12th, President Wheatland alluded to the death of Dr. Stimpson and called attention to the fact that his first experience in dredging, in which department of investigation he afterwards became so noted, was at a field meeting of the Essex Institute, of which he was a member. Mr. Putnam remarked on the great loss which science had met with in the death of Dr. Stimpson, and on his suggestion a committee was appointed to express, by a series of resolutions, the loss which the Institute experienced by the decease of its late member.

WE abstract the following notice of Major Lyon from the "Louisville Courier Journal" of June 25th: —

"Sidney S. Lyon, one of the most noted geologists in the West, died at his residence in Jeffersonville, Ohio, yesterday of paralysis, the result of wounds received during the late war.

Major Lyon was born in Cincinnati in the year 1807. He came to Louisville while a young man and supported himself for a time by portrait painting. Naturally of a studious disposition, and having an original mind, he became interested in the study of civil engineering. With the advantages of very little if any education at school, he applied himself at home and soon obtained a remarkable proficiency in the science; so great, indeed, had been his application and improvement that he was appointed by the Government, surveyor of the public lands in Texas. This exploration opened up to him another science that was just in its infancy. There were few works on geology when Mr. Lyon commenced the study, but he ' learned from the rocks.'

On his return from Texas he was appointed on the State geological survey of Kentucky with Dr. D. D. Owen, Prof. E. T. Cox, Leo Lesquereux and others, and it was on this survey that his eminent abilities as a geologist and topographical engineer were first made known to the scientific world. When hostilities commenced between the North and South, the United States Government secured the services of Mr. Lyon and he was attached to the command of Gen. Morgan, of the Fourth Kentucky Cavalry, as chief of the Engineering corps, and by his skill and particularly by his knowledge of the topography of Kentucky, rendered efficient service in the first campaign of the war. During this campaign, at Cumberland Gap, he received several wounds, from the effects of which he never recovered.

The home of Mr. Lyon on the Falls of the Ohio offered him peculiar advantages for the prosecution of his favorite studies. He devoted much attention to the Crinoidea of which he made a specialty, and his collection of crinoids is considered equal to any in the world. Mr. Lyon contributed several articles and drawings of new genera and species of crinoids, found at the Falls of the Ohio, to the Philadelphia Academy of Science. A large portion of the report of the Kentucky Geological Survey was also from his pen. The report of the Smithsonian Institute, for 1870, contains a contribution from Mr. Lyon upon the ancient mounds in Lyon County, Ky. For several years, however, his strength has not been equal to arduous work and he has devoted most of his time to study.

Mr. Lyon was eminently a self-made man. By persistent and earnest study, aided by a naturally fine intellect, he made himself one of the first scientists of this country, and his contributions to scientific knowledge have earned for him a lasting record in the roll-book of fame."

THE Royal Danish Society of Science proposes the following questions for competition for the year 1872: — *Question in History.* There has been discovered in late years, in the central and northern parts of Europe, an astonishing quantity of Roman and demi-Roman antiquities of the first centuries of the Christian

era. In the march of civilization, these "finds" throw light on certain interruptions and oscillations which seem to proceed from great wanderings of peoples who, in their turn, appear to be connected with the definite establishment of the iron age in the north, and with the first complete colonization of the Scandinavian peninsula. In order to explain this question, the Society asks for a description of the principal Roman and demi-Roman "finds" in the countries of the central and northern parts of Europe, which were situated beyond the borders of the Roman Empire, and also desires that this description be accompanied by an argument based as much upon these archæological data as upon historical documents, from which may be known the extent and importance of the current of Roman civilization in the countries mentioned and especially the changes which its interruptions and final cessation have brought on, in the civilization and colonization of the north.

Natural History Question. — It is now a hundred years since the celebrated observations of O. F. Müller on agamous reproduction (gemmiparity) of the Naiades was published, and although there is no reason to question their perfect accuracy on all essential points, it is very desirable to have them resumed in the actual light of science and with the means which it possesses to-day. Schultze, Leuckart and Minor have furnished history with valuable contributions of the manner of reproduction of the Naiades properly called, as Claus and Lankester have of Chætogaster; nevertheless, science ought to be in possession of materials sufficient for intelligence on all points of which it is necessary to keep account. It is not known definitely what is the first origin of buds or first individuals, and the relations between the modes of gemmiparous and scissiparous reproduction consequently need to be better explained; complete evolution, from the moment when one Naiad leaves the egg to that in which, among the generations sprung from that Naiad, there are found again sexual distinctions, has not been studied in all its phases, and it is still a question whether the same individuals (zoöides) are gemmiparous and sexual, or if the sexual and agamous reproductions are strictly distributed over different individuals or generations. As for the other two groups of Anellides in which agamous reproduction has been observed hitherto, namely, the Syllides and the Sepulides, the question is almost at the same point. For these reasons, the Society desires to urge a thorough research, and one answering the

actual demands of science, of agamous reproduction and all the points pertaining to it, of one of the groups of these setiferous Anellides. It therefore offers its gold medal as a prize to the one who shall solve this question in a satisfactory manner, either for one or several species of the group of Naiades (comprising Chætogaster) or for one or several species of Syllides or Tubicolides. The papers should be accompanied by the necessary drawings explaining the points on which the researches have especially borne. The answers to these questions may be written in Latin, French, English, German, Swedish or Danish. The papers must not bear the name of the author but a motto, and must be accompanied by a sealed note, furnished with the same motto, enclosing the name, profession and address of the author. The members of the Society who live in Denmark do not take part in the competition. The prize awarded for a satisfactory answer to either one of the questions proposed, is the gold medal of the Society (value, about $100). Papers must be addressed before the end of the month of October, 1873, to the secretary of the Society, Counsellor J. Japetus Sm. Steenstrup, Copenhagen.

The Hassler Expedition left Talcahuana on the 25th ult. for Juan Fernandez where we spent two days about the island and one day lying in the harbor, called Cumberland Harbor, which gave us an opportunity of making a very satisfactory collection for the short space of time. As Prof. Agassiz and Dr. Steindachner were left at Talcahuana to proceed over land to Valparaiso, all the work at the island devolved upon myself, but considering all the disadvantages, our trip there was a profitable one and amply paid us for the trouble. Our course was a direct line to Juan Fernandez and back to Valparaiso, thus forming a triangular track and soundings were made both ways, the deepest being 2,410 fathoms. The weather was very beautiful and just the kind for enabling us to carry on our work to advantage. We spent May day on the island and with a fair wind reached Valparaiso on the 5th. We intended to remain here only two days, or just long enough to take on board our coal, but owing to several delays we shall be obliged to remain here one week. All the time here will be improved by the party to make as complete a collection as the time will allow and we are in hopes to do much in that direction.

We shall proceed from here to Callao where I suppose we shall arrive in nine days, from there to Panama, then Galapagos, etc. Soundings and dredgings will be continued and we hope to reap much scientific knowledge. Professor Agassiz is very well, excepting somewhat fatigued from his overland travel, and all the rest of our company are enjoying good health. The Professor was most successful in collecting during his travel from Talcahuana. — J. HENRY BLAKE. *Valparaiso, May 11th.*

THE meeting of the American Association for the Advancement of Science, as announced in our last number, will be held in Dubuque, Iowa, on Wednesday, August 21st. The meeting will be called to order at 10 A.M. by President Gray. After the usual formalities of organization, the general meeting will adjourn and the members will meet in their respective sections for organization, and as soon as this is accomplished, the reading of papers will be in order. The order of the last meeting, by which the retiring president will preside during the first day and deliver his address in the evening, will be followed at this meeting, as it seems appropriate to have the president's address, and the formal resignation of his chair to his successor, on the first day of the session. We trust that at this meeting of the Association, members will not forget the important bearing which a proper organization has upon its scientific success, for certainly at several former meetings sufficient attention has not been given to the formalities required by the carefully prepared Constitution of the Association. Especially should care be used in the nomination of the six members of the Standing Committee, the Permanent Chairman, Secretaries and Committees of the Sections. Every year there has been more or less complaint in regard to the admission of papers which were not worth the time they occupied, and at times papers have undoubtedly been excluded that had better claims for admission than others which were allowed to be read. This will ever be the case to a certain extent, from the very nature of the Association, but we feel convinced that if the following clause of the Constitution were strictly adhered to, many of these complaints would be avoided.

RULE 9. No paper shall be placed on the programme unless admitted by the Sectional Committee; *nor shall any be read, unless an abstract of it has previously been presented to the Secretary of the Section*, who shall furnish to the Chairman the titles of papers of which abstracts have been received.

Still another Rule of the Constitution, if properly attended to by the Standing Committee, would certainly save the Association from the discredit of publishing a few papers which a good natured committee had admitted to be read and discussed (sometimes with the hope that the discussion on the paper would induce its author to withdraw it from publication), but which have not the merit of "advancing science." The execution of this duty of the Standing Committee would also probably save the Permanent Secretary much disagreeable correspondence during the "printing period" after the meeting, and though it might reduce the size of the annual volume, it would certainly add to its value as well as to the credit of the Association. We allude to Section 11 of

RULE 4. Before adjourning, [it shall be the duty of the Standing Committee] *to decide which papers*, discussions, or other proceedings, *shall be published*.

Another important item in regard to the success of the meetings, and one to which every member having a paper to present and the Standing and Sectional Committees should give their hearty cooperation, is that of the daily programmes. The Constitution "requests" members to send the titles, with abstracts of their papers, to the Permanent Secretary, at least a day previous to the commencement of the meeting; but there is often great delay in getting the list of papers presented in type, and still greater in arranging the programme for each day. This might be avoided by passing a vote providing that papers on the Secretary's list, at the meeting of the Standing Committee the evening before the first general session, should have precedence over all others in making up the programmes by the Sectional Committees. It would also greatly facilitate matters if the Sectional Committees were obliged to give their programmes for the day following to the Permanent Secretary by 4 o'clock in the afternoon previous, and the programme for the first day immediately after the organization of the Sections, not allowing papers to be read in a Section until its Committee had fully prepared the programme for the day; for it is almost always owing to the little confusion in calling up the first papers, without proper announcement, that renders it so difficult to get smoothly started in the scientific work, while a recess of an hour to enable the Committee to prepare the programmes would save much more time to the section than thus taken, and would give members a chance to greet each other before real work commenced.

The following are the officers of the Dubuque meeting. *President*, J. Lawrence Smith of Louisville, *Vice President*, Alex. Winchell of Ann Arbor. *Permanent Secretary*, Joseph Lovering of Cambridge. *General Secretary*, E. S. Morse of Salem. *Treasurer*, W. S. Vaux of Philadelphia. *The Standing Committee* consists of the above named officers and the following officers of the preceding meeting, Asa Gray of Cambridge, G. F. Barker of New Haven, and F. W. Putnam of Salem. (Six more members of the Standing Committee are elected at large from the Association on the first day, and the Permanent Chairmen of the Sections become members of the Committee.) *Local Committee.* — H. T. Woodman, chairman; C. A. White, 1st vice chairman; Asa Horr, 2d vice chairman; Samuel Calvin, local secretary; E. D. Cook, assistant secretary; R. A. Babbage, treasurer; and 205 other gentlemen. We are convinced by the cordial tone of the circular of the Local Committee and from private letters received, that the citizens of Dubuque are resolved to spare no effort on their part to make the 21st meeting of the Association a decided success. We quote the following items from the circular: —

On the evening of Wednesday, August 21st, a reception will be extended to the Association by the Hon. Wm. B. Allison, U. S. Senator elect, and Chairman of the Committee of Reception. Response from the Association, after which Prof. Asa Gray, retiring President of the Association, will deliver his address and give up the chair to his successor. From the success that has already attended the efforts of the Special Committees, and the expressed determination of the citizens to extend a liberal hospitality to the members, we can confidently promise that all can be entertained at private residences, *free of charge*, during the session. The Local Committee, therefore, earnestly request those intending to be present to notify the Local Secretary by letter as soon as possible. Members and those intending to become members will report immediately upon their arrival at the Reception Room of the Local Committee and register their names, when they will be conducted to the places to which they have been assigned. Notice of the location of the Reception Room of the Local Committee will be posted at the railroad depots, steamboat landings, and in the street cars and omnibuses of the city. Negotiations with the railroads have now progressed so far as to make it almost certain that we shall be able to give return passes over all the principal lines. All railroads leading from the city have generously offered the use of their lines for excursions to localities of special interest. Steamboats on the Mississippi river have also been tendered for a similar purpose. Arrangements for a number of excursions have been made, subject to the approval of the Association. Carriage excursions to the lead and spar caves, smelting furnaces, and to the exposures of fossiliferous rocks will also be provided for. Microscopists will confer, as soon as possible after their arrival, with the Curators of the Iowa Institute of Science and Arts at the Reception Room of the Local Committee, in relation to the care of any instruments or specimens they may have for exhibition.

"NATURE" for June 20th opens with a résumé of the discoveries of Livingstone, and gives an account of the latest authentic reports, which place him at Unyanyembeh, where stores were

being sent him under charge of his son. It is Livingstone's purpose to go southward and discover the outlet to the great basin of the Tanganyika, extending from about 3° to 10° S. lat. and 27° to 39° E. long., which he had discovered, and explored on all sides except the southeastern.

ANSWERS TO CORRESPONDENTS.

F. C. H., Yellow Springs; Ohio.— It is not at all improbable that some *Tachina* parasite infests *Coreus tristis* De Geer. It is well known that beetles in the imago state are sometimes so parasitized, and we have bred a small *Tachina-fly* from *Cassida aurichalcea* Fabr. See also AMER. NAT., Vol. V, p. 217. We should like specimens from *Coreus tristis*. — C. V. R.

Mrs. P. H., New Haven.—The specimens of insects you sent to the NATURALIST, and which you found in such numbers on May 20th, are doubtless the *Termes frontalis* Haldeman (order Neuroptera), and are called the American white ants. The workers and females are white and wingless. The males, which are mostly black and winged, appear in May and June and for a few days are often seen in countless swarms. These insects live in moist, decaying wood only, and doubtless found a congenial home under the doorstep mentioned. — E. N.

BOOKS RECEIVED.

Proceedings of the California Academy of Science. Vol. iv, Pt. iv, 1871. San Francisco. 1872.

Rectification of T. A. Conrad's "Synopsis of the family of Naiades of North America." By Isaac Lea. 8vo pamph. New Edition. Philadelphia. 1872.

Report of the Entomological Society of the Province of Ontario, for the year ending 1871. 8vo pamph. Toronto. 1872.

Preliminary Report of the United States Geological Survey of Montana and portions of adjacent Territories, being the 5th Annual Report of Progress. By F. V. Hayden, United States Geologist. Conducted under authority of Secretary of the Interior. 8vo. pp. 538. Illustrations and Maps. Government documents. Washington. 1872.

Annual Report of the Indiana Horticultural Society, Proceedings of the eleventh annual session held at Indianapolis, Jan., 1872. 8vo cloth. Indianapolis.

Natural History of the Tres Marias and Socorro. (From the Proceedings of the Boston Society of Natural History. June 7, 1871). By Andrew J. Grayson. 8vo pamph.

Amnesic and Ataxic Aphasia, etc. By T. M. B. Cross, M.D. 8vo pamph. Louisville. 1872.

Descriptions of New Species of Fossils from the vicinity of Louisville, Kentucky, and the Falls of the Ohio. From the collections of Dr. James Knapp of Louisville. By James Hall and R. P. Whitfield. 8vo. 8 pages. May, 1872.

Hypotheses. By F. J. Finols. 8vo pamph. pp. 32. 1872.

Nes Silicon Steel. 8vo pamph. Rome. 1872.

Custodian's Report of the Boston Society of Natural History for the year ending May 1, 1871. Boston. 1871.

Remarks on the Nomenclature of Achromatic Objectives for the Compound Microscope. By Dr. J. J. Woodward, U.S.A. 8vo pamph. (From the American Journal of Science and Arts, Vol. iii. June, 1872.)

On Reversions among the Ammonites. By Prof. A. Hyatt. 8vo pamph. 1870.

Catalogue of Spheniscidæ. By Alpheus Hyatt. 8vo pamph. (From the Proc. Bost. Soc. Nat. Hist., May 17, 1871.)

Monographie des Poissons de Cuba Compris dans la sous-famille des Sparini. Par Felipe Poey. (Extrait des "Annals of the Lyc. Nat. Hist. of N. Y.," Vol. x.) 1872.

Fifth Annual Report of the Provost to the Trustees of the Peabody Institute of the city of Baltimore, June 6, 1872. 8vo pamph. Baltimore. 1872.

Annual Report of D. F. Boyd, Superintendent of Louisiana State University, for the year 1871, *to the Governor of the State of Louisiana.* 8vo pamph. New Orleans. 1872.

Description of the Balænoptera Musculus in the possession of the Bost. Soc. Nat. Hist. By Thos. Dwight, Jr., M.D. 4to pamph.

Tri-Daily Bulletin and Tri-Daily Weather Map, issued at the War Department, Office of the Chief Signal Officer, June 1, 1872. 3 copies each.

Descriptions of New Species of Fossils from vicinity of Louisville, Ky. From the Collection of Dr. James Knapp. By James Hall and R. P. Whitfield. (Continued.) pp. 8. 8vo. June. 1872.

Proceedings of the Academy of Natural Sciences of Philadelphia. Part 3. Oct. - Dec., 1871. (Recd. July 1, 1872.)

History of the Names Cambrian and Silurian in Geology. By T. Sterry Hunt. (From the Canadian Naturalist, April and July, 1872.) 8vo. pp. 64.

Fossil Cephalopods of the Museum of Comparative Zoology. Embryology. By A. Hyatt. (Bulletin of Museum of Comparative Zoology, Vol. iii, No. 5, July, 1872) 8vo, pp. 59-112. 4 plates.

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THE CURIOUS HISTORY OF A BUTTERFLY.

BY SAMUEL H. SCUDDER.

Of all American butterflies *Brenthis Bellona* presents the strangest history. Everybody knows that butterflies pass through several stages of growth, from the egg, caterpillar and chrysalis to the butterfly — a cycle of changes which succeed each other with perfect uniformity from year to year; it is also known to most who read these pages that many butterflies pass through this cycle twice or even thrice in the course of the year, while others again are "single-brooded." If one should assert that *Brenthis Bellona* was single-brooded, most, if not all, observers would say it was an error; do not butterflies of this species, fresh from the chrysalis, appear late in May, again in July and still, once more, in September?—true, and yet, properly speaking, the insect *is* single-brooded.

In this genus — at least in *B. Bellona* and *B. Myrina* — occurs a phenomenon, which, so far as I know, is quite unique among butterflies; there are two sets of individuals, each following its own cycle of changes, apparently with as little to do with the other set as if it were a different species; each set has its own distinct seasons and thus gives rise to the apparition of two or three successive "broods" in the course of the year.

At the very end of the season this butterfly will be found laying eggs, which hatch in a few days; the little caterpillars, after

devouring their egg-shells, refuse further food and undoubtedly hibernate in this state—which is nearly equivalent to remaining in the egg; for eggs of Lepidoptera may be found in midwinter, in nearly all stages of development, according to the species. These juvenile larvæ represent the hiemal condition of one of the two sets of individuals above mentioned; this we will term the æstival series; for by the end of the following June, the caterpillars have attained their growth and, passing through the chrysalis state, emerge as butterflies about the middle of July; these are the butterflies of midsummer, continuing upon the wing until the end of September. In this butterfly, the eggs are wholly undeveloped at the birth of the female, and in the æstival series are not deposited until September; they hatch in from five to nine days and the young caterpillars, as we have said, pass directly into a state of hibernation, making the cycle of the year's changes complete with a single generation. This history is quite similar to that of the New England species of Argynnis, all of which are single-brooded, appear in early summer, lay their eggs in early autumn and hibernate as juvenile larvæ; but these have not superadded the second series of individuals which form so striking a feature in the natural history of some of our native species of Brenthis.

This second set of individuals, which we will term the vernal, in contrast to the æstival series, hibernates as *half-grown* caterpillars and produces the earliest brood of butterflies; these make their appearance about the middle of May, although they are occasionally seen earlier; they are hardly common before the end of the month and are as long-lived as their companions of the æstival series; they do not lay their eggs until the latter part of July and early in August—just when the butterflies of the æstival series are becoming common; the eggs hatch and the caterpillars grow as usual for a few weeks, sloughing their integuments twice; beyond this point all the caterpillars do not develop alike; some continue in what would appear the natural way; we will first follow them—it will be to their grave! As caterpillars they eat, as chrysalides they sleep and then appear in September, gay and frolicsome butterflies—doomed to an untimely end. Their sisters of the æstival series are busily laying eggs to perpetuate the race,*

* For the phenomenon of midsummer is now repeated inversely, one series ovipositing, the other emerging from the chrysalis.

but to them is this boon denied; the cold autumnal blasts sweep them away before the eggs are half developed in their ovaries. It is, in fact, a vain effort of Nature to develop a second brood which, in a more southern climate, with a longer season, would prove successful.

But we have said that this was the history of some only; and this fact proves the salvation of the vernal series; when about half grown, in the middle of August, while the weather is still hot, a portion of the caterpillars suddenly cease to eat and fall into a state of lethargy. Something similar to this, if we may trust the observations of Vandouer, as related by Doubleday, has been noticed in a European species of this genus, but earlier in the season, when it would seem to be more unaccountable, because, so far as we can see, less necessary. "Having succeeded," says W. Doubleday, "in obtaining some eggs of this species (*B. Euphrosyne*), which were laid about the middle of May, I fed the young larvæ produced from them until the end of June, when they all fell into a state of complete torpidity, in which most of them remained until the following spring. But in August a portion of them woke from their sleep, fed with voracity, changed their skins twice, became pupæ and in a few days perfect insects. It was only at the end of the following February that the others commenced feeding, changed their skins twice and after the first week in April became pupæ, from which the perfect insects appeared at the usual time." By this account, the butterflies lay their eggs on their first appearance; either they differ *in toto* from their congeners in America or there is some error in this statement. The state of lethargy into which our August caterpillars sometimes fall may perhaps be better denominated premature hibernation, for they do not arouse themselves until the following spring, when they again resume the cycle of changes peculiar to the vernal series, and by this extraordinary habit preserve its history.

Here we have two independent series in the same species, each single-brooded, but one making an effort toward a second generation, invariably ending in disaster; the butterfly may therefore be properly considered as "single-brooded," although differing greatly from other single-brooded butterflies, by presenting three distinct apparitions of the perfect form. Whether, by any lethargic freaks, the caterpillars of the two series even unite their faces and finally have a synchronous and parallel development, we are

as yet unprepared to say; but that the blood of both series ever commingles, through the union of the perfect insect, is very improbable because, although the generations overlap, the males of a brood are the first to disappear and the females the last to appear, and at best there would be few that could thus mate; moreover, since the eggs of the freshly enclosed females are not fully developed for weeks, or even months, the effect of such a union would be questionable. Yet, if there is no union between the two series, there are the vernal and æstival groups practically as distinct from each other as any two species! Nature strives toward the formation of a double brood in the vernal series; may we not suggest that she has already made considerable progress toward the development of a new species, in producing the vernal series at all? Pass in review the histories of different species of the same genus or even allied genera of butterflies, and you will find in them a remarkable similarity — trace of a law of unity in habits and seasons as pronounced as that of unity in coloration and structure, extending not only to the number of broods, but also to their seasons. In the æstival series of Brenthis we find indeed something very similar to what occurs in Argynnis, and this must therefore be considered the normal series; but, in addition, we have a second set of individuals maintaining a totally distinct season, by other means (lethargy or premature hibernation), passing the winter in a different condition, and even attempting an additional generation — showing a difference such as usually characterizes somewhat distant genera. Will not Messrs. Cope and Hyatt claim this as a new argument in favor of their theories of the origin of species?

Whether any colorational or structural features distinguish the butterflies of the vernal from those of the æstival series, I am unable to say and must leave to those who can follow the insect in the field; it is a question worthy of investigation, since the spring and autumn broods of butterflies often present differences so well marked that the broods have been described as distinct species.

Some one will ask whether these different apparitions of the butterfly cannot be accounted for on the supposition of a *single* series of individuals, with lethargy on the part of the caterpillar, as in the case of the European Euphrosyne. Plainly not; for we have in our butterfly three apparitions instead of two, and two

depositions of eggs in place of one; moreover, the fact is sufficiently established, that some of the caterpillars of the vernal series hibernate when half grown, after a period of lethargy and that the æstival series can only pass the winter as caterpillars just from the egg; so too is the period of oviposition; these facts being granted, and the apparition of the butterflies known to all observers as occurring at the times stated, any other interpretation seems impossible.

In all plural-brooded butterflies, with an extensive distribution in latitude, the number of generations varies with the length of the season. I am not aware that the mode of this variation has ever been studied; are the changes sudden or gradual? and do they involve any waste of energy on the part of Nature, as in *Brenthis Bellona?* A little consideration will show what the result would be in the species under discussion; should the season be so long that the second brood of the vernal series could lay eggs, these eggs would at once hatch, for their normal period being often as short as five days, weather which could induce a butterfly to lay eggs would at once ripen the embryo; the caterpillars would then be forced to hibernate as those of the æstival series and become members of that series the next year; while the vernal series would be kept up by means of those caterpillars of its first brood which, in the previous year, had gone into premature hibernation. Thus the vernal series would continually feed the æstival; yet it would suffer no greater loss than it does at present in the practical sterility of the September butterflies; it would be subjected to no infusion of blood from the æstival series and any variation of structure from the normal type of the species, induced by its isolation, would not be lost. Were the season still longer, the vernal series would become double-brooded and independent, the caterpillars having time to attain half their size before hibernation; the lethargic propensity would be retained only by the æstival series, which, by this time, would probably have assumed the position our vernal series occupied at the beginning.

If, on the other hand, we suppose a shorter season, such as actually exists in some parts of the country where *Brenthis Bellona* occurs, undoubtedly the first change would be the entire elimination of the September butterflies and the hibernation of all the vernal caterpillars when half grown; this is probably the actual state of things in the cooler parts of Canada; but what would be

the further backward steps toward the simple condition of Argynnis —that is, toward the extinction of the vernal series—it would be hard to conjecture, without treading on insecure ground; rather let us leave that to the future development of parallel facts. —*Menton, France, April*, 1872.

ON THE GEOLOGY OF THE ISLAND OF AQUIDNECK AND THE NEIGHBORING PARTS OF THE SHORES OF NARRAGANSET BAY.*

BY PROF. N. S. SHALER.

General Topography.—The contour of the shore at this point of our coast at once indicates some peculiar features in the history of the rock masses in which it lies. A great indentation of the coast line having a width of twelve and a depth of over twenty miles, cut here and there with narrow islands and running up into the land in long river-like arms for many miles beyond the limits of its main area, Narraganset Bay, leads us to seek for some forces operating in its formation which were not at work, at least with the same energy, in the region of shore more to the southward and westward. A glance at the general topography will show us more clearly what is to be regarded as peculiar and requiring an explanation from the ancient history of this region.

Nearly the whole of the excavation of Narraganset Bay lies in a region commonly known as Carboniferous.† The great excavations of the Chesapeake and Delaware lie altogether in a region of soft, easily disintegrated material and are thus not comparable with what we have here. The valleys of the Connecticut, the Hudson and the Thames, nearer to the region we are studying, are in the same sort of rocks, or those of nearer equivalent hardness, and are therefore more likely to give us a measure for the forces acting here. But we find that these latter

* This and the papers to be hereafter published in the same series, are extracts from a Report to Prof. Benj. Pierce, Superintendent of the United States Coast Survey, and are made public by his permission.

† It will hereafter be shown that a very large part of this region generally mapped as carboniferous is in all probability of a very much earlier age. The evidence goes to show that it is a member of the Cambrian series.

indentations have the simple structure of river excavations presenting, it is true, the character of valleys which have been subjected to other eroding forces than those which have come from flowing water, but still being single and rather narrow indentations in the axis of considerable streams. As we go to the north and east beyond Narraganset Bay, we find indentations of the same general character; at first, obscurely on the southern shore of Massachusetts, but in great abundance and of a perfectly comparable shape on the coast of Maine and the whole shore of the continent to the northward. Thus we see that this Bay is, in fact, the southernmost point of the fiord structure on our coast and is on this account a favorable point for the examination of the causes of the formation of that type of coast line. If we take a number of sections across the whole of the Bay at several points, say at the mouth, five miles from the southernmost point of land, again parallel thereto through the centre of the town of Newport, and further on in succession in an east and west direction through the upper part of Newport island and the island of Prudence; through Bristol and lastly through Fall River, we shall see by these diagrams that the bay gives us a number of furrows and ridges having each a width of from half a mile to five miles and a height or depth from the bottom level of from one hundred to four hundred and fifty feet.* If, however, we take a section in a general north and south direction through any of these channels of Narraganset Bay, we shall find that it presents us with essentially an inclined plane sloping pretty gradually from the northern or inner end toward the sea on the south. The indentations of these channels into their shores are comparatively few and of no great depth. At some points the original islands have been soldered together by marine drift materials so as to destroy the original simplicity of arrangement, but usually throughout the Bay the contours show us a predominance of north and south reliefs. As will be seen by examining the contour lines of the coast survey map, on the scale of $\frac{1}{10,000}$, the nearer ridges of the principal island conform in course in a general way to the trend of the shores of the main islands; showing thereby that it is to some very general action that we owe the existence of these north and south trends.

*Three of these transverse sections are given in the diagram Pl. 6. It will be seen that each great channel is a broad but relatively shallow excavation. The drawings from which the sections were made were carefully prepared from the records at the Coast Survey Office in Washington.

It will be noticed that the island has no streams of considerable size; none, in fact, which could have been competent to create the wide and deep depressions we find in the larger valleys of the island by direct abrasion. In some of the minor valleys near the shores, as at the glen on the east side of the island, we have real stream valleys with the normal V-like excavations, but in the larger depressions occupied by the streams the form is very much more rounded and the size usually many times as great, giving broad U-shaped troughs, in which the streams, though in fully close contact with the bed rock, have very little effect upon it. They are manifestly incapable of creating the valleys in which they flow. To account for these depressions we are forced to suppose either of several things; we may suppose that the valleys are the relics of the topography which may have existed here before the Bay was formed, and that the streams which made them gathered their volume in the land which then occupied the space where the waters now lie and a part of the region beyond; we may seek an explanation of their formation in the action of the sea during a former period of partial submergence, a probable source of valley-making, according to the view of many geologists, or we may perchance find that to the erosion of the ancient glacial streams we owe the development of what the brooks only began.

The first supposition is manifestly inapplicable to a number of the valleys of the island, and these among the most important; that which owing to the want of any well established name has been termed the north valley, being that occupied by the stream which debouches just south of the Aquidneck coal mines, does not extend across the island but has its head within fifty feet of its highest hill. On the part of the island to the south of this valley we have several considerable depressions of the same character. Only one of these, that which lies immediately to the north of Newport, is continued clear across the island, but even here the central part of the valley lies so high as to afford hardly a reasonable impression of its having been the valley of an ancient river. A careful consideration of the question has led me to conclude that this hypothesis is inapplicable to any of the valleys of the island. The question of the marine origin of these depressions is easily dismissed. If competent to produce these valleys we should find the sea still at work extending their contours at the point of contact of sea and land. It is sufficiently evident that no such action is now going on. The sea is now making slight inroads upon

the land along nearly the whole shore of the island, but the slight waste is not taking place in any greater measure at the mouths of these valleys than at other points. I am inclined to think it eminently probable that these valleys are the result of the amplification of the original stream excavations, by the action of the moving sheet of ice which we shall see there is abundant reason to believe to have rested on this region during the drift period. Long before the present topography was established, probably at a time so remote that the present surface was buried more than one thousand feet beneath accumulations, which have since been worn away, the island had already been separated from the main land. The ice period found certain valleys already cut in the rock, their general course coinciding pretty closely with the direction of the flow of the ice, as will be seen by examining the indicated direction of the ice as determined by the glacial scratches. It is eminently probable that the glacial sheet was pretty nearly level on its upper surface, not having that surface conforming to the hills and valleys which lay beneath. It is evident that where the stream lay deepest the wearing would have been the greatest, for the rate of motion being the same, the wearing of a glacial stream is in proportion to the weight it brings upon equal areas. Thus the valleys would have been deepened and widened until out of proportion to the magnitude of the streams of water which course through them since the glacial sheet went away.

The importance of this consideration has been overlooked; it needs to be considered if we would form clear ideas of the cause of the irregularity in the excavations of all glaciated regions. Sometimes this great difference in the erosive action may be in part attributed to the difference in hardness of the rock acted on. But that this is not the principal cause is shown by the great irregularity of glaciated surfaces and underlaid by the most uniform syenites. In ordinary ærial erosion the beds of the streams are generally kept away from the rock by a padding of debris; but in glacial action these protective agents in running streams become the very sharpening of the ice tool and do the work of erosion instead of protection. By reference to the diagrams (Plates 6 and 7), it will be seen that the channels between the islands have an average depth of about one hundred feet below the water line. They gain their depth quite suddenly and then preserve their gentle slopes across their whole breadth. Their variations in

depth may sometimes be connected with a variation in the hardness of the material in which the excavation is made.*

Since the formation of these depressions a considerable amount of filling has been going on which has doubtless done much to modify the form of the bottom and diminish its depth. There are no data for estimating the amount of the accumulation; it has probably not exceeded an average of one hundred feet. Although not expressly made for that purpose, the diagrams also show that the land surfaces are considerably more irregular than those caused by water; water action when the land is buried beneath it tends to make the surfaces uniform while it works to the opposite effect when it acts upon the land lands. There are reasons to believe that the channels to the east and west of the island were occupied by distinct glacial streams for a short period towards the close of the last ice time. The duration of these local glaciers must have been short, inasmuch as the distinct termina lor lateral moraines are few and indistinct.

Excepting the extreme ends of the island the topography is of the simplest character; the broad valleys have slopes of remarkable similarity showing that the material in which they are excavated must have a tolerably uniform consistency. The extreme southwest and northeast ends of the island have contours which contrast remarkably with the middle region. The region known as the neck, lying just south of Newport and the harbor thereof, is one of the most irregular surfaces in New England. At first sight it seems a mere confusion of ice-worn rocks and transported masses piled without order. A little examination shows, however, that here too we have a set of valleys which have a prevailing north and south course, the sides and bottoms of which have been worn into the irregular shapes, which give the chaotic look to the surface, by the action of the flowing water and the old ice mass. The rock being of very varied hardness has worn with different rapidity at different points and so has come to have a very rugged surface. The lines of fault indicated in the diagrams† bring up into contact with this irregular surface the beds of the coal formation, materials as homogeneous as the others are variable. The homogeneity in the character of the latter rocks has caused them

* The great valleys which now form the Bay were doubtless originally the insignificant troughs of small streams which have been developed under the conditions above indicated.

† These diagrams will be given in the next number of this Journal.

to wear uniformly and so to give a very even surface to the country they underlie. This uniformity characterizes all the region between the Lilly Pond and Almy's Pond on the south and the bay known as Blue Bill Cove on the north, with the exception of the strip lying east and west between the Paradise and Purgatory rocks on the east and Miantonomi Hill on the west, wherein there are several exposures of conglomerates and slates which, wearing unequally, have given a broken and irregular character to the surface.

At the extreme northern end of the island, between Blue Bill Cove and the portion of Narraganset Bay known as Mount Hope Bay, there is a small area of the same character as that to the south of Newport, brought up by a fault into contact with coal-bearing rocks. Here also the irregular hardness of the rock has caused it to wear very irregularly.

The continuous sheet of superficial accumulations hereafter to be described does not have any considerable effect in altering the contour of the surfaces except in the finer details of particular points. On the west shore of Blue Bill Cove there is a surface of about one hundred acres which shows a type of topography which occurs at a number of points on our New England shore and is very difficult to understand. The general surface is very nearly a true plane and is underlaid to the depth of more than thirty feet, or below low tide mark by unstratified drift composed principally of materials less than one foot in diameter. The surface of this plain is broken at a great number of points by depressions which recall the character of the sink holes of many limestone countries, though no such explanation will possibly apply to their formation. These depressions vary much in size some of them being several hundred feet in diameter, though usually they do not exceed one hundred feet across, and twenty feet in depth. Generally their outlines are rudely circular, though in some cases they exhibit considerable irregularity of form. At some points these cavities are so crowded together that they encroach upon each other and the plain becomes converted into a warped surface of a singular degree of complication. A precisely similar surface occurs on the low terrace to the south of the town of Quincy, Mass. The conditions both of material and environment are the same in both cases.

There are a few possible means of accounting for this arrange-

ment which suggest themselves; none of them, however, seem quite to satisfy the facts. The most natural conjecture seems to be that the irregularity was made at the time of deposition of the material. Had it taken this shape afterwards the only possible supposition would be that marine currents had produced the excavation during a period of depression. This, however, is distinctly negatived by the fact that the coarse as well as the fine material has disappeared, there being no such mass of boulders on the bottom of the depression as would exist on this supposition; moreover, it is really impossible to account for the existence of such great eddies in the positions where these great excavations occur, at points remote from large obstacles such as could set great tidal currents whirling. Limiting ourselves to the conditions which could cause irregularities in the deposition of the drift, we still find the matter beset with difficulties. In the first place, it is difficult to see what could have caused such lacunes in the distribution of drift matter, within or on the surface of a glacial sheet. The most satisfactory explanation seems to be that the greater part of the drift which lies here was borne on the surface of the glacier and that these openings in the moraine matter answer to gaps in the ice on the surface of the glacier, caused perhaps by the action of streams such as are often seen to originate on the surface of a glacier and then to find their way in straight shafts to its base. Such cavities would remain even after they became closed or disused, being covered with drift or quite bare, and at the time of melting their place would be marked by just such cavities as these.

Other depressions exist on a larger scale at the points occupied by the several ponds of the island; none of these ponds seem to be complete rock basins all having, or having had, deep channels connecting them with the sea. Blue Bill Cove seems to be entirely formed by the drift masses which surround it, except when the syenite rock makes a part of its northeast border. Easton's Pond, near Newport, is the next depression to the southward. We have one of the valleys of the island cut down by the glacial stream until its mouth lay beneath the level of the sea; when the ice disappeared the valley constituted a fiord-like bay. The action of the sea seems to have made two successive beaches across the valley, one about one-half the distance from the present shore to the head of the pond, the other forming the present bathing

beach of Newport. South of this point we have two considerable ponds, Almy's and Lilly pond; both of these and the marshy pond just to the west of the latter are glacial excavations. The last is closing by the accumulation of vegetable matter, its waters having become shallow enough to bear an abundant vegetation, which is rapidly converting it into a peat bog. The island is singularly free from perfectly level lowlands, such as are formed by the filling up of old ponds, and the few sheets of water which remain are not disappearing with the rapidity usual in New England.

The process of occlusion in these ponds can be studied to advantage in the marshes between the Lilly pond and Bateman's. The vegetation, consisting of a variety of marsh plants, begins its growth at the shore where there is a sand beach and bold water, but it may be a long time before its foothold can be made good. Some accident such as a landslide or a fallen tree makes a little shelter, so that the plants get a hold in the water. In a short time they make a bed a foot or more in thickness; their roots go so deep that soon they can stand a considerable beat of the wave. The commotions in the water tear away and distribute over the floor of the pond a part of the mass, but it continues to grow and gains on the clear space, often at the rate of several inches a year. Where the circumstances are favorable, we find the mat of plants extending from the shore over the pond, without touching its floor, sometimes for only a few feet, again, at times, covering many acres with its growth. The accumulation of sediment under these conditions takes place in a singular fashion; the mat of vegetation floats upon the surface of the pond, and sinks deeper and deeper as it grows until, finally, it rests upon the bottom. It then continues to grow until it has gotten itself so far above the water, that the vegetation no longer has the necessary amount of water.*

The topography of the island, as a whole, is remarkable for the small extent to which it expresses the structure of the rock below.

* This process of growth makes the peat bogs of all countries the natural repositories of the implements of man: where a stone tool remained on the surface it was likely to be found again and again, and used until its very chips were worn away. Falling into a bog, slipping through some crevice in its top crust, it sank to a secure hiding place. The fact that implements can penetrate so deeply into bogs makes them very untrustworthy recorders of time. An implement of the stone age may get buried in the solid matter two feet from the surface, while a modern piece of work falling into a more open spot may sink far below it. When the bog comes to be excavated the deeper buried object is naturally, but mistakenly, taken for the older.

When we come to study the disposition of the underlying rock we shall be struck by the great amount of perturbation the beds have suffered; they are thrown into real mountain irregularities. Few parts of the Alleghanies are more seriously disturbed, but the surface preserves no semblance of mountain forms. It does not differ from the shape which horizontally lying rock would give. If the character of the surface had been given by water action, then we should have had something very different from this. The valleys would then have mapped for us the attitude of the strata and the elevations would have been much greater and differently disposed from what they are now. But under the sheet of ice these details of structure lose their value; the ice cannot turn and twist as the water does, only a slight deflection even under the most important resistance can be permitted. The result necessarily is that the glacial stream wears away without much reference to the disposition of the beds beneath the surface. This is a point of more than local importance; it may serve often as a general guide to the determination of the question whether any particular country shows the result of glaciation. When the topography of any region does not express the structure of its underlying materials, in the fashion common to all surfaces of purely aqueous erosion, then there is reason to suspect the action of ice. This suspicion may amount to a certainty wherein the whole topography has been created with the great independence of internal conditions which it here exhibits.

There is a general absence of sand and pebbles in the beaches about this island; this is, probably, primarily due to the fact that drift has not been enough washed over by the sea to remove the arenaceous matter. The sand mass of Nantasket or Lynn beaches alone much exceeds all that exists in the spits and beaches about Narraganset Bay. The small extent to which the drift has been robbed of its sands is due to the original slight submergence of this district; only about ten to twenty feet of emergence is indicated, so the region has not been so much washed over as the region more to the north. There are great bodies of sand on the shores to the north and south; its comparative absence here is to be explained by the want of recent great movements of the land, and the deep water which prevents its movement along the shore from the east or west. As we go south of this region we come into the area of positive subsidence since the glacial period. This

change of land is quite as favorable to the collection of sand along the shore line as the process of elevation. In general the existence of great quantities of sand along an ocean shore may be taken as probable evidence of recent geological movements which have enabled the sea to work over a great amount of débris, of which it has left the heavier part where it found it, and has heaped up the lighter parts where its currents naturally swept them. It will hereafter be shown that the whole region of Narraganset Bay has less drift than exists in the regions further to the northward; it also has few stretches of shore which furnish quantities of sand to eroding agents and none of those great rolling beaches, such as abound to the northward where thousands of tons of pebbles, rushing to and fro under the beat of the waves, are gradually ground into sand and mud. The rocks exposed about Narraganset Bay to the full surge of the ocean are mostly stubborn resisters of the waves, and where masses break away they generally fall into deep water where they are not ground up by the waves. There are no currents working along the shore, which are capable of transporting sands from either the Cape Cod shore or the great masses of Long Island. We see that circumstances have coöperated to keep the inlets of this diversified and beautiful region of our shore free from the overwhelming sands, which in the regions a little to the east or west would have soon closed or effaced them. Nothing can be more strikingly contrasted than the topographical results of water in its solid and its fluid states. Where it moves from the land in the solid phalanx of the glacier it rends a coast into shreds, as ragged as a cloud blown out by the wind. In the sea with the ever varying action of waves and currents, it works to restore the uniformity it destroyed before. Its waves dig down the heights and fill up the hollows, its currents build moles across the inlets and give them over to the agents which speedily convert them to marshy plains.

At the close of each of the many great ice periods in the earth's history the fretted line of the fiord zone was probably swept clear of its débris of all kinds. Then began the process of occlusion which continued until the ice came again to renew its work.

In recognizing the harbors and inlets of Narraganset Bay as glacial work, we get an example of the agent which has given nine-tenths of the havens of our seaboards. That the people of the northern part of Europe have been universally maritime is

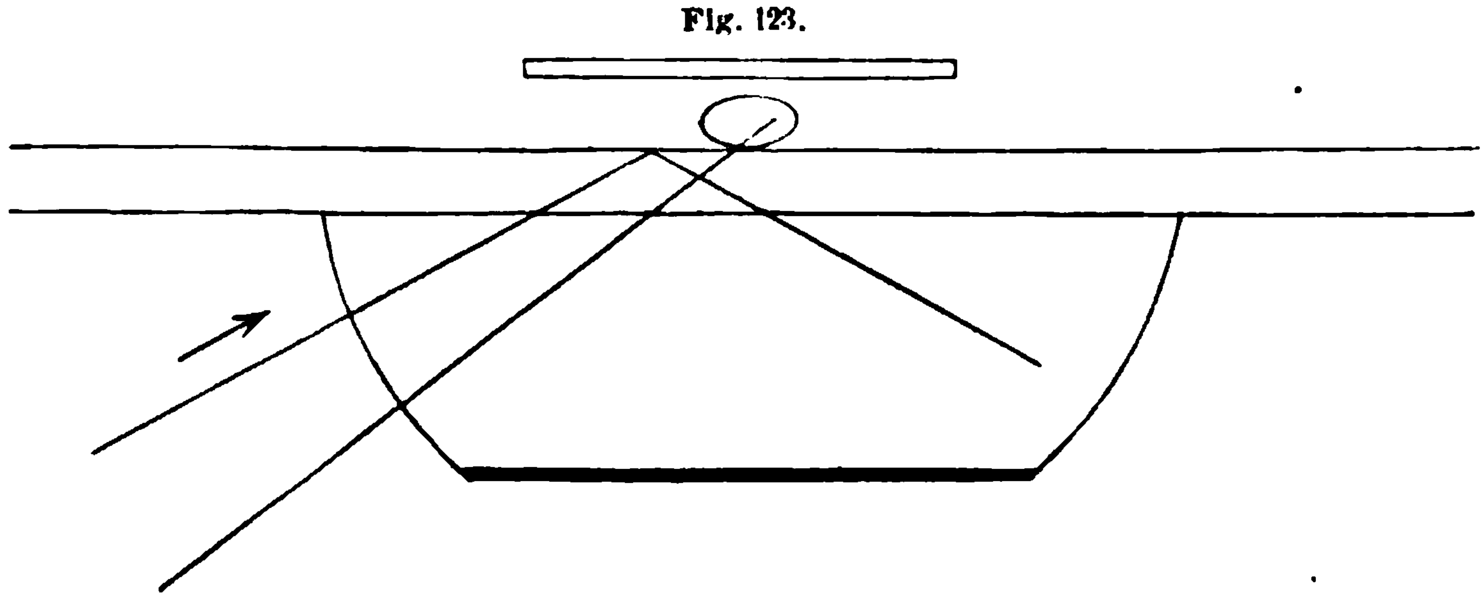
due, in no small degree, to the recurrent ice action of the northern hemisphere, so close is the connection between this most destructive agent and the highest life.

THE NEW IMMERSION ILLUMINATION.

BY R. H. WARD, M.D.

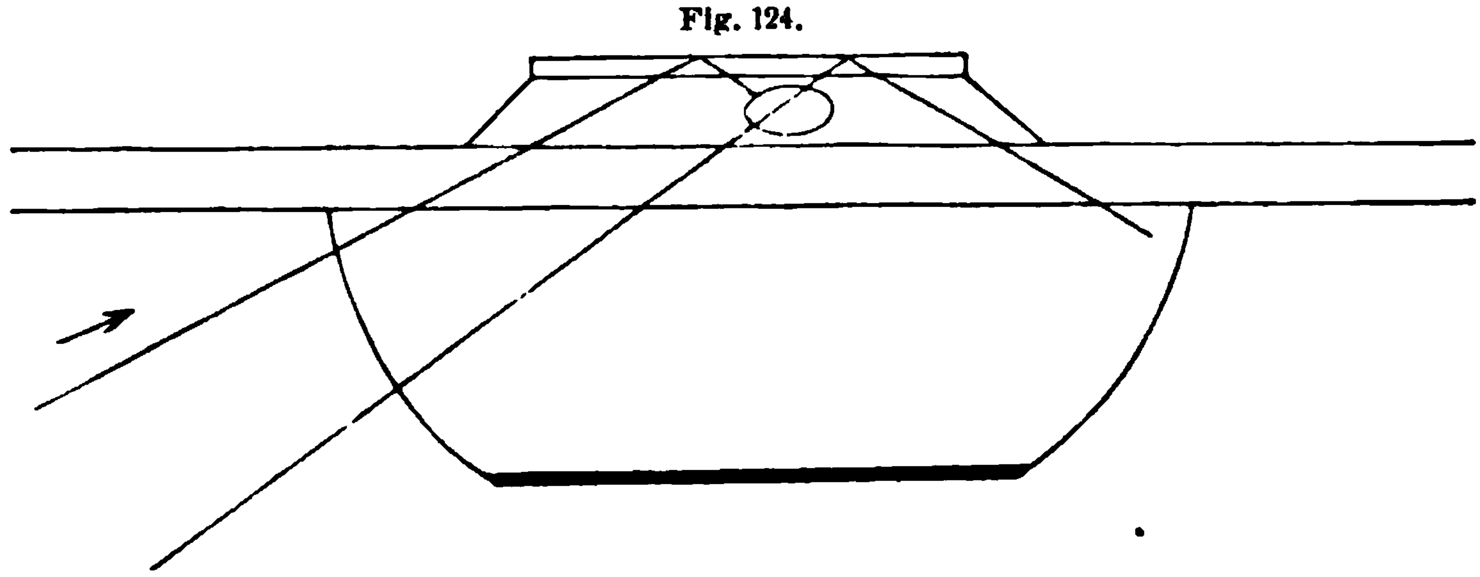
The new illuminating lens, introduced by Mr. Wenham recently, has proved to be a sufficiently important accessory to the microscope to command more attention than it has yet received in this

Fig. 123.



country. A small plano-convex lens, nearly hemispherical, has the central part of its curvature stopped off with black varnish; and for convenience the part intended to be thus suppressed

Fig. 124.

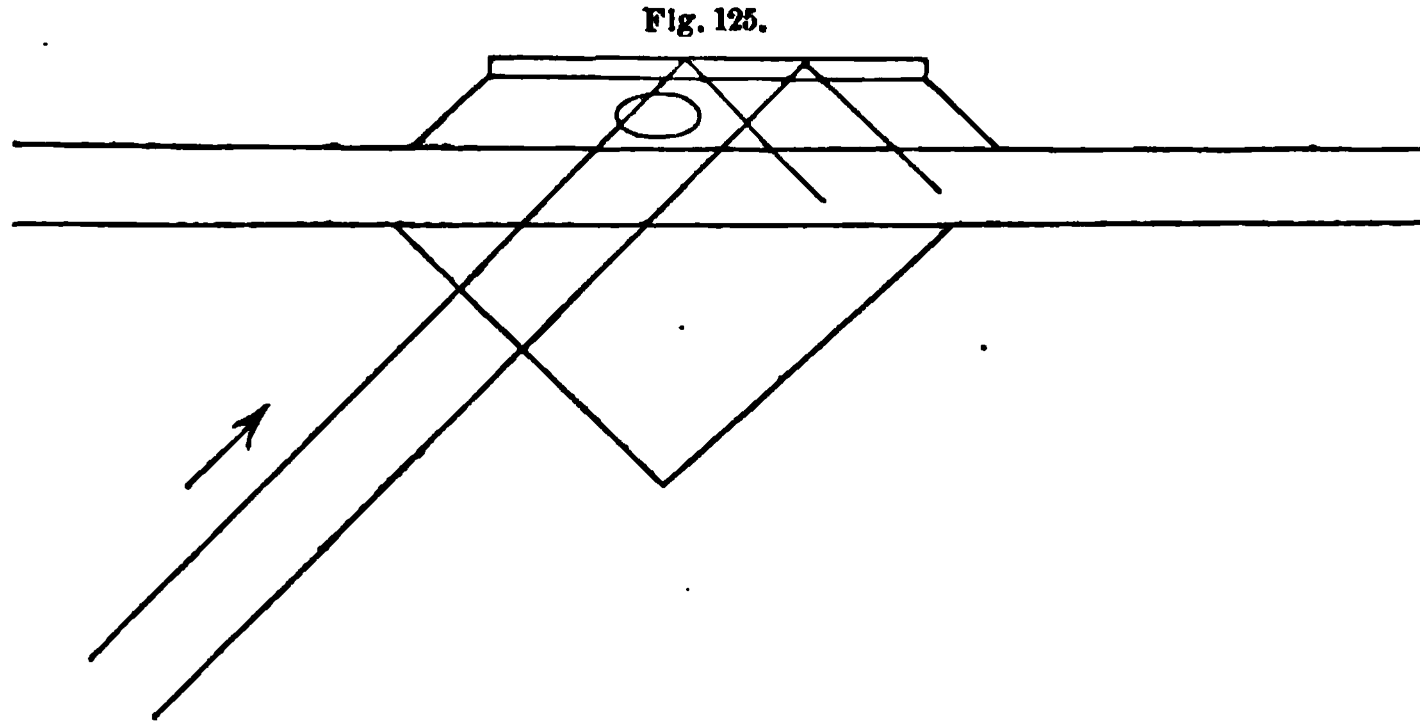


may be ground away as shown in Figs. 123 and 124, the ground surface being subsequently painted black. The lens thus prepared is temporarily attached by some highly refracting medium, such as

glycerine or oil of cloves, to the under surface of the slide. It becomes, manifestly, an immersion spotted lens; though it has lost so much of its angular aperture, to say nothing of the difficulty of placing the object in its focus, that it can no longer be used as such. Its available action is that of enabling us to throw light obliquely into the slide at such an angle, ordinarily impracticable, that it shall suffer total internal reflection from the top of the slide (Fig. 123), or from the top of the glass cover when that is optically identified with the slide, as when we examine an object in balsam, glycerine, etc. (Fig. 124).

For many years our best means of producing this effect was a prism, as shown in Fig. 125. A small prism is attached to the under surface of the slide, temporarily, by soft balsam or by oil or glycerine in the case of mounted specimens, or permanently,

Fig. 125.



by balsam to a blank slide which is to be used for the occasional examination of unmounted specimens. This arrangement gives so little light, and so little control of the angles at which the light meets the axis of the object and the axis of the instrument, that it has been but little used and with indifferent results.

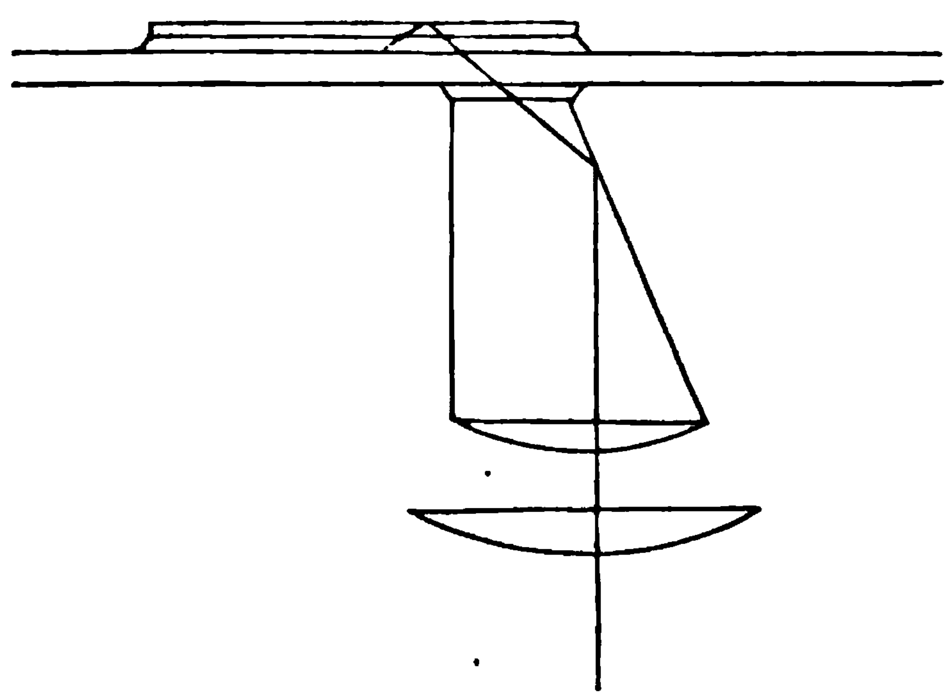
Mr. Wenham's lens removes all these difficulties. It is easy to get light enough for moderately high powers; and the light can be thrown upon the object at a considerable range of angles and from any side or from all sides at once. When light is to be supplied from one side only, it may be directed by a rectangnlar prism or a Reade's prism, or an (inclined) achromatic condenser of long focus and small angle—such as a two-inch or three-inch objective; while from all directions at once it is best supplied by the common glass paraboloid. The latter effect may be obtained, as explained

by Prof. Biscoe, by the common paraboloid alone, it being converted into an immersion instrument by filling its cup with water.

These means of illumination, now for the first time available, may act in three distinct ways, one of which is new.

The new method is applicable only to objects mounted dry, and is illustrated by Fig. 123. It has been called, by Rev. S. Leslie Brakey, Internal Illumination. All the light suffers total internal reflection from the upper surface of the slide except that which meets the surface at the points of contact of the object, and the rays thus excepted enter and illuminate the object. Of course the object must lie upon the slide, and beginners are often puzzled by

Fig. 123.



failure, not suspecting or remembering that the object may have been mounted upon the under surface of the cover.

The two other methods are the common opaque illumination and dark-field illumination, which are illustrated together in Fig. 124, as they are usually employed together in practice. They are applicable only to objects mounted in some medium, in which case the top of the cover becomes, optically, the first surface reached by the light after entering the lens. The upper ray in Fig. 124 represents this method of opaque illumination, the ray being reflected by the cover upon the object. The lower ray represents the dark-field effect, the object being illuminated precisely as by the common paraboloid, only the field is darkened not by the obliquity of the rays passing through the cover but by the fact that they are reflected back by it.* Hence its greater complete-

* This illumination is not exactly represented in the diagram. Most of the light reflected down by the cover is that which passes by the side of the object, and not that which passes through the object. This is shown in Fig. 125, but simplified in Fig. 124.

ness and its applicability to large angular apertures. Its effect is superb with powers as high as $\frac{1}{8}$ of 130° or 140°, especially when used with the binocular.

In practice it is not easy, nor often necessary, to separate the latter two methods. They separate themselves according to the character of the object. With an absolutely opaque object the opaque illumination will alone be accomplished, the dark-field effect (lower ray of Fig. 124) being necessarily suppressed; and success will probably be difficult and only indifferently good. With sufficiently translucent objects the opaque effect would be insignificant, but the dark-field effect easy and excellent. Objects just opaque enough to answer equally to both methods give a confused result, which might possibly be valuable in exceptional cases.

The latest contrivance (Mr. Wenham's, of course) for an immersion illuminator is a glass cylinder half an inch long, one side of which is ground off at an angle of 64° and polished to furnish an internally reflecting surface. The upper end approaches the bottom of the object slide, the interval being filled with water as in the use of an immersion lens, and the lower end is ground to a convex surface whose refracting effect on the pencil of light is supplemented by a plano-convex lens placed below it. In fact we have something like a Wollaston's doublet for a condenser, whose cone of light is twice bent by internal reflection so that its apex is in the position of the object between the cover and the slide. In the diagram (Fig. 126) only a central ray is represented; but in use nearly all the light falling upon the lower lens is brought to a focus on the object, giving an abundance of light and remarkable results with high powers. The apparatus is so mounted on the sub-stage as to rotate around its own focal point as a centre; and excels the former appliances in giving a more intense one-sided illumination, in confining the light to the object instead of lighting up everything in the neighborhood, and in allowing the slide to be moved or changed with facility.

Immersion achromatic condensers for transparent (bright-field) illumination have not yet received sufficiently extensive trial to ascertain their exact degree of usefulness; but they seem likely to come into use as a means of increasing the available angular aperture of immersion objectives, if not for other purposes.

ON THE CAUSE OF DETERIORATION IN SOME OF OUR NATIVE GRAPE-VINES, AND ONE OF THE PROBABLE REASONS WHY EUROPEAN VINES HAVE SO GENERALLY FAILED WITH US.

BY C. V. RILEY.*

THE GRAPE-LEAF GALL-LOUSE (*Phylloxera vitifoliæ*† Fitch.).—The experience of the past year, enables me to add much of interest and importance to last year's account of the above insect. This experience has already been made public in an article published in the "Rural New Yorker," and reproduced in the "Rural World" of St. Louis. I am pleased to know that the views there set forth receive the indorsement of such an experienced and practical man as Mr. Geo. Husmann, the well known grape authority in our State, and editor of the vineyard department of the last named journal.

It is well known that nearly all the varieties of the European grape-vine (*Vitis vinifera*) have, in the end, proved valueless when introduced and cultivated in the eastern half of the United States. The majority of them grow well at first, and a few exceptional cases might be mentioned where some of them, such as the Black Hamburg and Chasselas, have even fruited successfully for many years, especially when isolated or trained against walls; while

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* We copy this from Mr. Riley's 4th Report as Entomologist to the State of Missouri, 1872, and have to thank Mr. Riley for the use of the cuts.—EDS.

† This is the specific name by which I last year gave an account of this grape-vine insect; and I employ it again for that very reason, and for the further reason that it is the name most familiar to the American reader. I have already given my opinion (3rd Rep. p. 95, note) that though the name is objectionable, it ought perhaps to be retained. It is doubtful, however, whether many other entomologists will agree with me; and while I believe in carrying out the "law of priority" to its fullest extent, consistent with reason, there are many cases where it must give way to that of "accord." The present is, perhaps, just such a case; for aside from the technical objection, Dr. Fitch knew so little of the insect's true characters, when he named it, that he cannot be said to have described it, and did not refer it to its proper genus which was already erected to receive it. His name will, therefore, doubtless give way to that of *Phylloxera vastatrix*, which Planchon first gave to the root-inhabiting form, and which has generally been recognized abroad. The same may be said of Westwood's name *Peritymbia vitisana*, which was also proposed for the same insect in 1868, in a communication to the Ashmolean Society of Oxford, England.

they more generally do well when isolated in cold houses. But the general truth of the first statement holds good. It is also well known that some of our native vines, which for a while were universal favorites on account of their productiveness, vigor and other excellent qualities, have of late years sadly deteriorated. Among such the Catawba was for a long time the popular grape; but its cultivation is now entirely abandoned in many parts of the Mississippi Valley, and even at Hammondsport and other parts of New York, and Nauvoo, Illinois, where it is still largely cultivated, I learn from experienced grape-growers that it is fast on the decline.

This deterioration—this failure, has been attributed to a variety of causes, for in the absence of anything definite and ascertainable to keep it within bounds, the speculative turn of our minds is sure to have full scope, and grasping at every shadow of probability, leaves no possible theory unsearched. As in all such cases, also, the mind gets lost in, and is satisfied to vaguely rest with, the theory least provable; and to some occult and mysterious change of climate we are at last satisfied to attribute the change though, if the meteorological records were carefully examined, they would probably show no difference in the mean annual condition of our climate during the past half century.

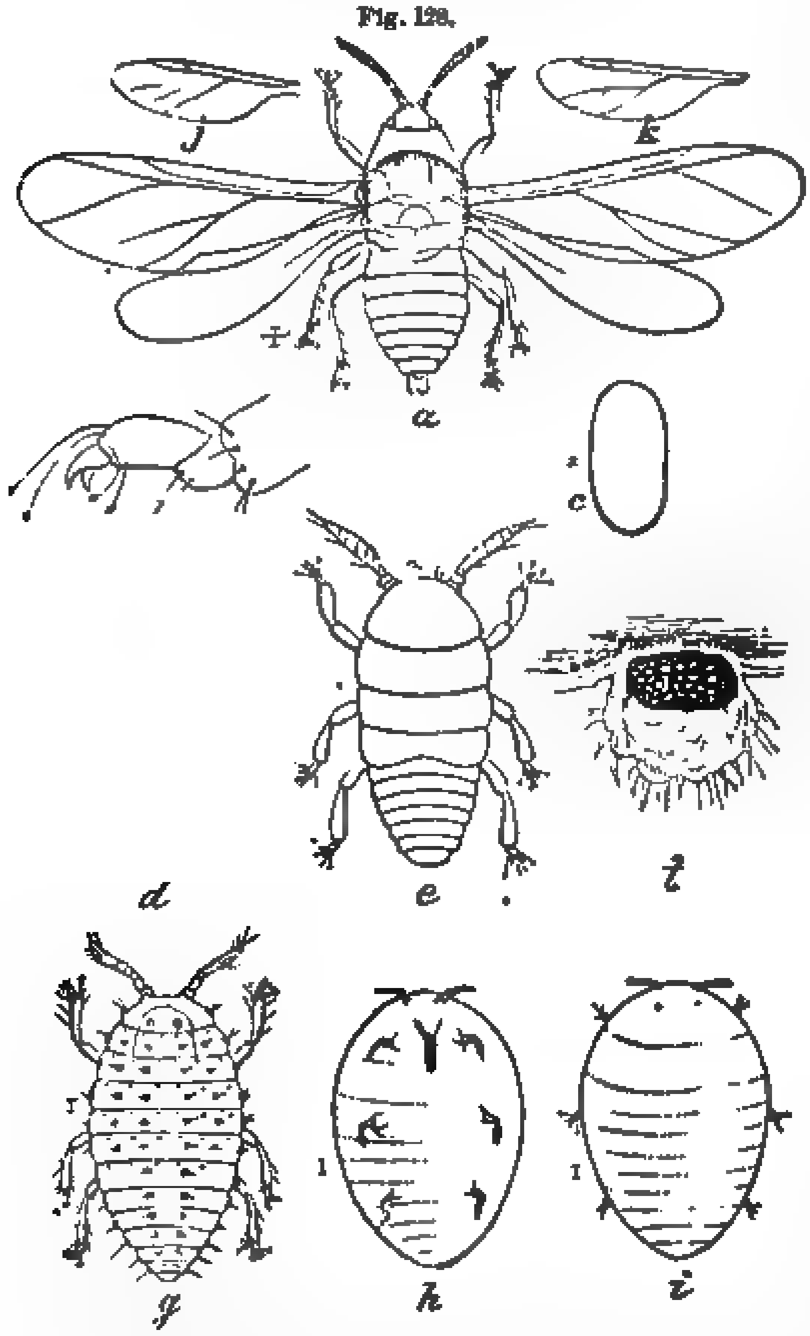
Fig. 127.

Leaf covered with galls.

It is very natural to suppose that vines of European origin should be less hardy in this country than our native varieties, that as in the case of the Spanish Chestnut, the English Gooseberry, etc., etc., there is something in our climate which precludes their flourishing as well here as there. I would by no means deny that such is the case, for it is this very comparative tenderness which predisposes them the more to the destructive agent of which I am about to speak. Yet when we consider that in some

parts of Europe, where the Vine flourishes, the extremes of heat and cold are as great as here; that we possess a great variety o soil and climate, and that by covering and other modes of protection in winter, we may, where necessary, counteract the rigor of the latter — it would appear that we certainly have attributed too much to climatic influence: and such a view is strengthened by the fact that our native varieties, if free from the insect which forms the subject of this article, usually do well when cultivated in Europe, and further that the *Vitis vinifera* is not a native of Europe, but of western Asia.

Fig. 128.



Grape Gall-louse; *a*, winged female; *b*, her tarsus, *c*, egg, *d*, the newly hatched gall-inhabiting type, ventral view; *e*, dorsal view; *f*, section of a gall; *g*, the tubercled root-inhabiting form; *h*, the mother gall louse at the height of her fertility, ventral view, *i*, dorsal view; *j* and *k*, differently veined wings of the Oak *Phylloxera* from Europe. All these figures are greatly enlarged, the natural size being shown by the hair lines at the side of each.

The above reflections are of a general character, but apply more particularly to the great State of Missouri, which is admitted to be, in many parts, eminently adapted, both by soil and climate, to the cultivation of the Vine.

One of the reasons why the European vines do well in California, outside of and beyond the more favorable clime in that portion of the continent is, no doubt, because the insect which here affects them, like many other species common on this side of the Rocky

Mountains, has not yet crossed to the other side. If such is the case, our California neighbors should take warning from Europe, and guard, if possible, against an invasion.

The announcement that I have at last ascertained one of the principal causes, if not the sole cause, of this decline, and that, knowing the cause, we may in a measure obviate it, will doubtless cause many a grape-grower to wonder. Some may even pooh-pooh the idea, and deem it impossible that they have so long remained in ignorance of so important a fact, that a "bug-hunter" should discover it at last. Let the facts speak.*

This destructive agent is none other than the little insect we are now treating of.

The general history of the louse, and the habits of the gall-inhabiting type were sketched in my last Report, and need not be repeated.

FURTHER PROOF OF THE IDENTITY OF THE AMERICAN INSECT WITH THE EUROPEAN.—That the two are identical there can no longer be any shadow of a doubt. I have critically examined the living lice in the fields of France, and brought with me, from that country, both winged male and female specimens, preserved in acetic acid. I find that the insect has exactly the same habits here as there, and that winged specimens which I bred last fall from the roots of our vines, accord perfectly with those brought over with me. In the different forms the insects assume, in their work, and in all other minutia, the two agree.

WHY I CONSIDER THE GALL-LOUSE AND ROOT-LOUSE IDENTICAL. —First, wherever this insect has been noticed in England, both the gall-inhabiting and root-inhabiting types have been found. In France, the galls occur abundantly on such of our American

*It is really amusing to witness how the facts here set forth have been received by hose who never spent ten minutes' investigation of the subject in their lives. In the silk-worm disease that has of late years been so prevalent in Europe, M. Pasteur, after the most painstaking and elaborate experiments, at which he sacrificed his health, unravelled its mysteries, gave to the world the true pathology of *pebrine*, and what is more, showed how it might be eradicated. Yet, as I shall show further on, the men most interested were very slow to believe the hard, dry facts which had been snatched from the unknown, and, never having studied the case themselves, were more inclined to consider the disease as something mysterious—something altogether beyond man's understanding, and consequently uncontrollable. The most ignorant are always the most skeptical! I might mention several parties who have expressed their opinion that the *Phylloxera* has no connection with disease or decline in the Vine. To such, I simply say: examine for yourselves, before giving an opinion. Others whom I might mention go to the other extreme and assert that it must be the cause of mildew, oidium, etc., and without any good reason put a similar opinion in my mouth. To these last, I say: read aright, do not misconstrue, and by no means jump to conclusions!

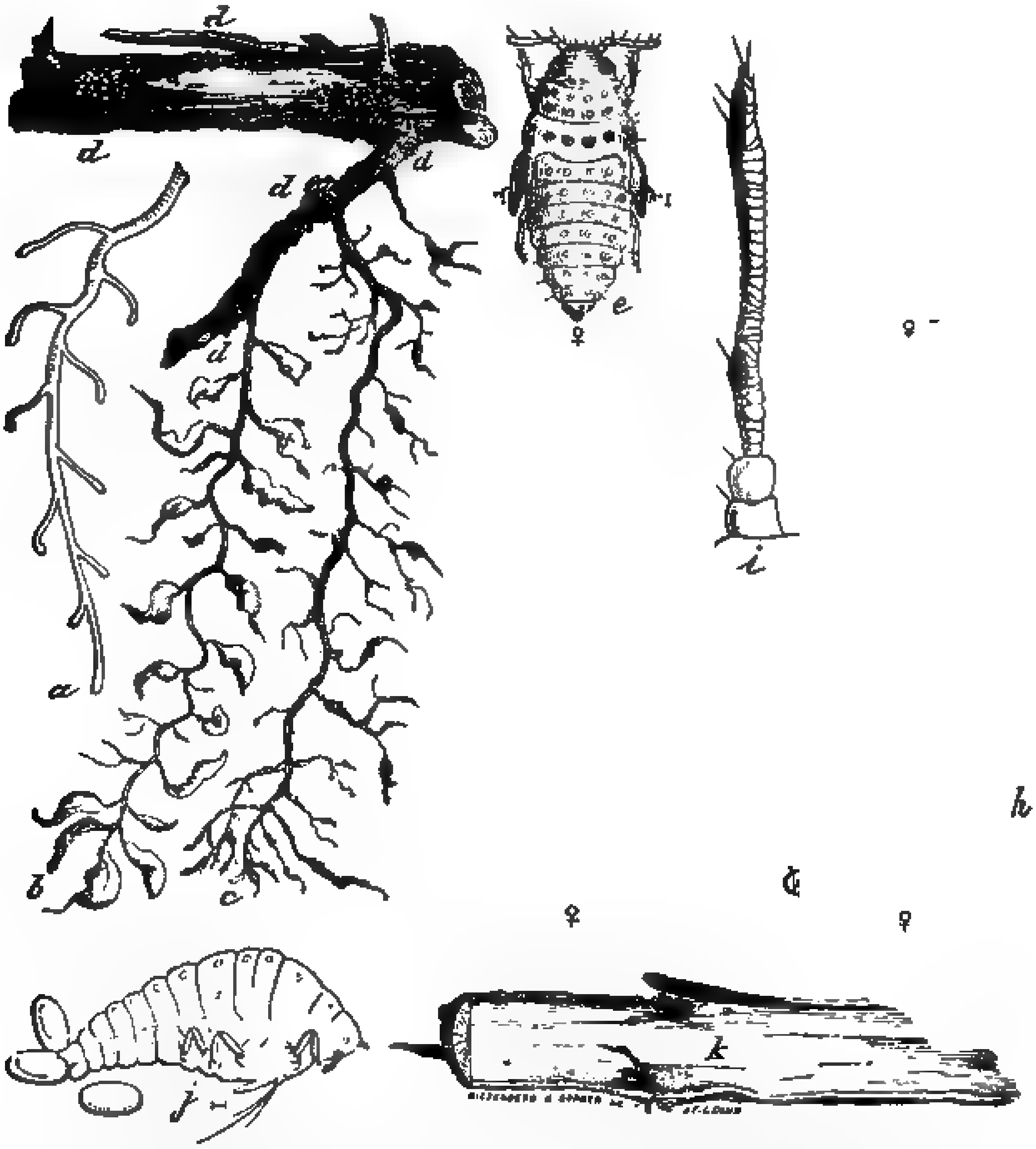
varieties as are subject to them here; while a few have occasionally been found on their own varieties. Secondly, I have successfully transferred the leaf-lice on to the roots, while M. V. Signoret has succeeded in obtaining leaf-galls from lice hatched on the roots. Thirdly, the winged form obtained by Dr. Shimer from the galls in this country agrees in its characters with those from the roots. Fourthly, the nodosities on the roots are, as already stated, perfectly analogous to the galls on the leaves, and differ only in just such a manner as one would expect from the difference in the plant tissues — a view greatly strengthened by the fact that when the gall-lice are forced, by their excessive numbers, to settle on the tendrils or leaf-stalks, they produce swellings and knots approaching more nearly to those on the roots than to the galls. These facts sufficiently attest the identity of the two types, and we have here another case of an insect possessing two distinct habits. It is also like many others of its family, polymorphic, *i. e.*, it exists in different forms; yet we have to do with but one species.

FURTHER FACTS RESPECTING THE HABITS OF THE ROOT-INHABITING TYPE. — The young hatched from the eggs on the roots are absolutely undistinguishable from those hatched in the galls; and the gravid apterous female differs in no respect whatever from the mother gall-louse. There is, however, a different egg-depositing form, which, as it moults, becomes tubercled, and more elongated or pear-shaped, as shown at Figure 129, *j*. Some of these tubercled individuals remain without wings, while others seem to be destined from the first to acquire wings. The young, after attaching themselves, become in a measure stationary, and remind one very much of young bark-lice. The fine hair-like setæ, which in their functions and elasticity are analogous to our tongue, become loosened from the more fleshy rostrum or sheath, as shown at Figure 129, *j*, and are often so firmly inserted into the root that the louse, if disturbed from its place, generally hangs by them. Three of the threads of this tongue are sufficiently conspicuous, but there should be from analogy, four. The females on the roots seem to be less prolific than those in the galls, and their eggs if anything are rather larger. These eggs are always of a bright yellow color, and, on the dark root, are detected with the naked eye as readily as the lice, which become darker or of a dull orange as they grow older.

The insect is found on the roots in all stages during the summer

months. In the winter it is found dormant, principally in the larva state, and no eggs are to be seen. With the circulation of the sap in spring, the activity of these young recommences, and

Fig. 120.



a, shows a healthy root; *b*, one on which the lice are working, representing the knots and swellings caused by their punctures; *c*, a root that has been deserted by them, and where the rootlets have commenced to decay; *d*, *d*, *d*, shows how the lice are found on the larger roots; *e*, female pupa, dorsal view; *f*, same, ventral view; *g*, winged female, dorsal view, *h*, same, ventral view; *i*, magnified antenna of winged insect; *j*, side view of the wingless female, laying eggs on roots; *k*, shows how the punctures of the lice cause the larger roots to rot.

in a short time afterwards eggs are deposited again. At this season the punctures of their little beaks produce very decided swellings and an excess of moisture at the wounded parts. The winged forms are by no means uncommon and commence to issue

from the ground perhaps as early as July. When I last examined the roots before my departure, or about the middle of May, no pupæ were found; but winged insects were obtained as early as July in France, and after my return I had no difficulty in obtaining all I wished, especially during the latter part of September. The pupæ are easily recognizable with a good lens, by the little dark pad-like wing-sheaths at the sides of the body (Fig. 129, *e*, *f*)—and the sexes may even be distinguished at this stage by the greater constriction of the body near these pads in the female, compared to the male, her abdomen being larger. Before giving forth the winged insect, these pupæ become quite restless and active, and in a state of nature they no doubt issue from the ground.

The winged female (Fig. 129, *g*, *h*) seems to be much more common than the male, and is distinguished by her more lengthened abdomen — the wings, when closed, extending not much more than its length beyond the tip, while in the male they extend more nearly three times its length. The dusky thoracic band is not so distinct and the abdomen is more produced at the apex in the male; and there is also a slight difference in the venation of the wings of the two sexes, which venation is best seen in the fresh specimens, as it becomes in a measure obsolete in drying. In the abdomen of the female two or three large eggs are plainly visible, especially after being soaked in acetic acid. The two-jointed tarsus or foot is also plainly visible in such specimens, and I have found the joint movable, while M. V. Signoret, of Paris, has obtained the skin of the tibia or shank with the basal joint of the tarsus hanging to it. Prof. Westwood also refers to a short basal tarsal joint in the gall insect which he described. These facts, trivial as they may appear, are very important in a scientific view, as they forever settle the differences that have existed as to the proper systematic position which the louse occupies.

SUSCEPTIBILITY OF DIFFERENT VINES TO THE ATTACKS OF THE LOUSE.—I have carefully examined a great many different kinds of vines within a circuit of thirty miles of St. Louis, as well as in Cole, Jefferson and Boone counties, in this State, and the summary which follows indicates the susceptibility of the different varieties to this disease. There may be objection on the part of some persons to the placing of some of the varieties in the following tables and the opinions both of botanists and vine-growers

are so at variance that I shall give in the subsidiary note * my reasons for so placing them. I am familiar with the views of many of the leading grape-growers of the country, and have had an opportunity of studying the genus by the excellent herbarium

* CLASSIFICATION OF THE N. A. GRAPE-VINES.—In few genera of plants is it more necessary to accumulate abundant material in order to arrive at correct classification than in the genus *Vitis*. The species are with difficulty defined, as they vary in a marked manner in different sections of the country; and the foliage of the same individual vine often varies greatly at different ages and seasons. Preserved leaves are not alone to be trusted therefore, but every stage of growth must be considered, from the wood to the different leaves, the blossom, bunch, berry and even the seed, which in its shape, and especially in the development of its raphe (or cord) furnishes, according to Dr. Engelmann, some of the most permanent distinguishing traits between the species.

It is interesting to know that not a single real species has been added to those belonging to the old territory of the United States, east of the Mississippi river, since the time of Linnæus and Michaux; though Rafinesque, LeConte, and perhaps others, have attempted to distinguish a great many more.

The number of Grape-vines bearing edible fruit,* now considered species by the best botanists in the territory of the United States, is limited to 9. They may be tabulated as follows:

I. VINES WHICH ARE OF PRACTICAL CONSEQUENCE, AS HAVING YIELDED OUR DIFFERENT CULTIVATED VARIETIES.

1. *Vitis Labrusca* Linn. Northern Fox.
2. " *Æstivalis* Michx. Summer Grape.
3. " *Riparia* Michx. River Bank Grape.
4. " *Vulpina* Linn. Southern Fox, or Muscadine.

II. VINES OF LESS CONSEQUENCE, AND WHICH HAVE THUS FAR GIVEN NO CULTIVATED VARIETIES.

5. " *Vitis Cordifolia* Michx. Winter or Frost Grape.
6. " *Californica* Benth. Confined to California.
7. " *Arizonica* Engelm. Similar to the last.
8. " *Candicans* Engelm. Mustang Grape of Texas.
9. " *Rupestris* Scheele. Bush Grape or Sand Grape.

Of these 9 species only 4 grow wild in our own state, viz; *æstivalis*, *cordifolia*, *riparia*, and *rupestris*.

In stating last year (3rd. Rep. p. 90) that our cultivated varieties had been referred to four species, including *cordifolia* and omitting *riparia*, I followed the later editions, of Gray's Manual, in which the latter is considered as a variety of the former. The reasons for adopting a different course will be found in the following synopsis which has been kindly prepared for me by the author.

THE TRUE GRAPE-VINES OF THE OLD UNITED STATES.

BY DR. GEORGE ENGELMANN OF ST. LOUIS.

1. GRAPE-VINES WITH LOOSE BARK (AT LAST SEPARATING IN SHREDS), CLIMBING BY THE AID OF BRANCHED TENDRILS, OR (IN NO. 4) SCARCELY CLIMBING AT ALL.

a. Berries small, 3—6 or rarely 7 lines in diameter; seeds obtuse, with the raphe (or cord) more or less prominent (except in No. 4) over the top. All the species of this group,

* There are a few species forming the sections (or, according to others, genera) *Cissus* and *Ampelopsis* which are now classed with *Vitis*; but they bear no edible fruit, and are otherwise easily distinguished from the true grape-vines.

of Dr. Engelmann. It is gratifying to know, therefore, that the position given to such cultivated varieties as obtain in this herbarium, agrees with that given to them by leading grape-growers — the views of the botanist and the practical man coinciding.

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just like the European grape-vine, exhibit on well grown shoots a regular alternation of two leaves each having a tendril (or its equivalent, an inflorescence), opposite to them, and a third leaf without such a tendril.

1. VITIS CORDIFOLIA *Michaux* — Usually tall, climbing high, trunks not rarely 6—9 inches in diameter. Leaves middle sized, heart-shaped, mostly entire or rarely slightly trilobed, with shallow broad teeth, usually smooth and shining on both sides, the young ones sometimes slightly downy below; berries among the smallest; in large bunches, black without a bloom, maturing late in the fall, usually with only one short and broad seed marked by a prominent raphe.

This is a common plant especially of the river-bottoms, and well known under the name of Winter grape, Frost grape or Chicken grape. It is found from New England to Texas, and westward to the western limits of the wooded part of the Mississippi valley. In this valley, at least, the fruit has a strongly- and even fetidly-aromatic taste. No cultivated varieties of the species are known.

2. VITIS RIPARIA *Michaux*—Mostly a smaller plant than the last, but with larger and more or less cut-lobed glabrous shining (or rarely when young, slightly downy) leaves, the lobes long and pointed; the teeth also more pointed than in *cordifolia;* berries as small, or usually larger than in the last, mostly with a bloom, in smaller bunches, mostly 1 or 2 seeded; seeds with a less prominent raphe.

This species prefers thickets or rocky soil on river banks and extends as far west and south as the last, and much farther north, being the only grape-vine in Lower Canada, where it is found even 60 miles north of Quebec. The northern form, in Canada, northern New York to Michigan and Nebraska, has fewer and larger berries in a bunch and is easily distinguished from *V. cordifolia.* The southwestern form, however, approaches more closely to this last species, with which Prof. Gray in the later editions of his Manual has united it. The fruit ripens earlier than that of *cordifolia*, and is much pleasanter. In St. Louis a variety found on the rocky river banks is brought to market in July. A number of cultivated varieties are referable to this species, among which the *Taylor Bullit*, the *Delaware* and the *Clinton*, are the most prominent.

3. VITIS ÆSTIVALIS *Michaux* — Smaller than the first, climbing over bushes and smaller trees, leaves large, of firmer texture than the preceding ones, entire, or often more or less deeply and obtusely 3-5 lobed, with short and shallow, broad teeth; when young always very woolly, mostly bright red or rusty; at last smoothish but dull and never shining like the preceding ones; berries usually larger than in both others and, when well grown, in compact bunches, coated with a distinct bloom; seeds usually 2 or 3 with a very prominent raphe.

This is the well known *Summer grape* common throughout the middle and southern States, usually found on uplands and in dry open woods or thickets, maturing its fruit in September. It is the most variable of our grape-vines and hence has seduced superficial observers into the establishment of numerous nominal species. A form with large leaves which retain their rusty down at full maturity has often been mistaken for *Labrusca*, which does not grow in our State. Another form, more bushy than climbing, with deeply lobed rusty-downy leaves and very sweet fruit, is *Vitis Lincecumii* of the sandy soil of Louisiana and Texas. This species assumes a peculiar form approaching *V. cordifolia* through its smaller black berries without bloom and in larger bunches, when it gets into shady woods with rich soil. Another form, with ashy-white, downy, scarcely lobed leaves, and fruit like the last mentioned, which grows in our bottoms, often climbing high trees, or growing over bushes on the banks of lakes, I have distinguished by the name of *cineria.* It is not always easy to distinguish such forms from the other species and perhaps less so to unite them under the

When we find it so difficult to properly separate the wild species, we can no longer wonder at the difference of opinion as to the nature of many of our cultivated varieties; for some of them have become so modified that they furnish scarcely any indication of their parentage. If those grape-growers who take interest in such matters will send specimens of such cultivated varieties as they wish to properly classify, to Dr. Engelmann, either directly or through me, they will at least get the opinion of one who is

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single species *æstivalis*, unless the essential characters above enumerated be closely attended to, and the numberless gradual transitions from one form into the other be watched.

We cultivate many varieties of this valuable species, the most important of which are the *Virginia seedling*, the *Cynthiana* and the *Herbemont*.

4. VITIS RUPESTRIS *Scheele*—A small bushy plant, often without any tendrils, rarely somewhat climbing; leaves small (2—3 inches wide) mostly broader than long, heart-shaped, scarcely ever slightly lobed, with broad coarse teeth and usually an abruptly elongated point, glabrous, and of a rather light green color; berries middle-sized, on very small bunches; seeds mostly 3—4, obtuse, with a very delicate raphe.

This very peculiar grape-vine is found only west of the Mississippi, from the Missouri river to Texas and westward probably to New Mexico. In our State where it is called *Sand grape*, and in Arkansas, it grows on the gravelly banks and over-flowed bars of mountain streams; in Texas also, on rocky plains, whence the Latin name; it is there also known under the name of *Sugar grape*. Its luscious fruit ripens with us in August.

It is nowhere yet in cultivation but may in future prove of value.

b. Berries large, 7-9 or even 10 lines in diameter; raphe scarcely visible on the more or less deeply notched top of the seed.—These plants on well grown shoots bear a tendril opposite each leaf with only rare and irregular intermissions.

5. VITIS LABRUSCA *Linnæus*—Plants usually not large, climbing over bushes or small trees, though occasionally reaching the tops of the highest trees, with large (4-6 inches wide) and thick, entire or sometimes deeply lobed, very slightly dentate leaves, coated when young with a thick rusty, or sometimes whitish, wool or down, which in the wild plant remains on the lower side but almost disappears in the mature leaf of some cultivated varieties: berries large, in rather small or middle-sized bunches, bearing 2 or 3 or sometimes 4 seeds.

This plant, usually known as the *Fox-grape* or *Northern Fox-grape* is a native of the eastern slope of the continent from New England to South Carolina, where it prefers wet thickets; it extends into the Alleghany mountains and here and there even down their western declivity, but is a stranger to the Mississippi Valley. The most important varieties of this grape-vine now cultivated in our country (such as the *Catawba*, *Concord*, *Isabella*, *Hartford Prolific*, and dozens of others) are the offspring of this species; they are all easily recognized by the characters above given, and more readily by the peculiar arrangement of the tendrils as above described.

II. GRAPE-VINES WITH A FIRMLY ADHERING BARK, WHICH DOES NOT SCALE OFF; TENDRILS ALMOST ALWAYS SIMPLE; BERRIES VERY LARGE (7—10 LINES IN DIAMETER), VERY FEW IN A BUNCH; SEEDS WITH TRANSVERSE WRINKLES OR SHALLOW GROOVES ON BOTH SIDES.

6. VITIS VULPINA *Linnæus*—Bushy or sometimes climbing high, with small (2 or at most 3 inches wide) rounded, heart-shaped, firm and glossy dark green leaves, smooth or rarely slightly hairy on the under side, with coarse, large or shallow teeth.

good authority, and such action may be mutually profitable. Specimens should be sent at flowering time, and should include the whole shoot with full sized and young leaves, blossom, and tendril; and after the fruit is ripe a bunch of the berries and seeds from the same stock should follow.

The proper classification of our different varieties is of more importance in this connection than would at first appear. Since the publication of some of the facts set forth in this article, a few enterprising French grape-growers, in the districts desolated by the louse, have conceived the idea of importing from this country such varieties as are most exempt from the attacks of the *Phylloxera*, and M. LeFranc, the Minister of Agriculture, has likewise expressed his intention of so doing. Already a number of varieties, and especially the Cunningham, Herbemont, Norton's Virginia, Concord, Hartford Prolific, Clinton and Martha have been shipped to M. J. Leenhardt, of Montpellier, France, and others to Switzerland, by Messrs. Isidor Bush and Co. If America has given this plague to England, why should she not in return furnish her with vines which are capable of resisting it? At least nothing but good can come of the trial, for though our grapes are generally sneered at on the other side of the water, we have made such rapid improvements in viticulture during the last ten years that they scarcely know anything of our better kinds; and many of those which do well in Missouri will doubtless succeed in France. Such of our vines as have already been cultivated there are often differently classified by their writers to what they are by American authors, and confusion consequently ensues. Thus, one of my correspondents, M. Laliman, of Bordeaux, who has cultivated a number of them for several years, classes the Clinton and

This southern species known under the name of *Southern Fox Grape Bullace* or *Bullit-grape* is found along water-courses, not farther north than North Carolina and Arkansas, and may possibly straggle into southeastern Missouri. Some of its cultivated varieties, especially the white *Scuppernong*, are highly esteemed in the South but do not perfect fruit in the latitude of St. Louis.

I recognize only three other species of the true grape-vines in the territories of the United States. The most remarkable of these is the Mustang grape of Texas, *Vitis candicans* Engelm. (*V. Mustangensis* Buckley), with rather large, rounded, almost toothless, rarely deeply-lobed leaves; white woolly on the under side, bearing berries, which in its native country are now beginning to be made into wine; *Vitis Californica* Bentham, the only wild grape of California, has rounded downy leaves, and small berries, and is not made use of as far as is known; *Vitis Arizonica* Engelm., similar to the last, but glabrous, with middle-sized berries, reported to be of a luscious taste. Neither of these shows a prominent raphe on the seed, so that this character is peculiar only to the first 3 species here enumerated.

Taylor as *æstivalis*, and the Norton's Virginia and Delaware as *Labrusca*.*

I will now indicate the susceptibility of different varieties to the disease.

Vitis vinefera (European).— All European varieties with roots badly affected. In many instances decomposed and gone, with the vines about dead. No leaf-galls.

V. riparia (River Bank). Clinton — Leaf-galls extremely abundant. Root-lice only moderately so. Taylor—Where leaf-galls are few, root-lice abundant; where galls are abundant fewer root-lice. Delaware — A few leaf-galls; lice abundant on roots. Othello (hybrid with *vinefera*) — Both leaf-galls and root-lice, the latter tolerably numerous. Louisiana (some say a seedling of *vinefera*, others again believe it *æstivalis*) — Leaf-galls and root-lice, but neither bad. Alvey — Few leaf-galls; plenty of root-lice. Cornucopia (hybrid with *vinifera*)— No leaf-galls; roots badly affected with lice. Wild vine —Numerous leaf-galls and a few root-lice; much in same condition as Clinton.

V. æstivalis (Summer). Cunningham — No leaf-galls, but a few root-lice. Cynthiana—Occasionally a few galls; lice abundant on roots. The vine has a vigorous growth and the roots are large and strong. Herbemont — A few leaf-galls, and scarcely any root-lice. Norton's Virginia — No leaf-galls, but some root-lice.

V. Labrusca (Northern Fox). Isabella, or seedlings of Isabella—No leaf-galls; a few root-lice: roots strong and vines flourishing. Martha—No leaf-galls; very few root-lice. Hartford—No leaf-galls; very few root-lice. Ives—No leaf-galls; lice tolerably abundant on roots. North Carolina—No leaf-galls; very few root-lice. Maxatawney—No leaf-galls; root-lice quite abundant. Creveling—A few leaf-galls; root-lice abundant. Catawba —No leaf-galls; root-lice very numerous, abounding even on the larger roots as on the European vines. Gœthe (hybrid with *vinifera*)—No leaf-galls but lice on roots very numerous. In the vineyards of Messrs. Isidor Bush & Sons, of Bushburg, Mo., this vine was very vigorous and thrifty in 1869 and 1870, but has done poorly the present year. Dracut Amber—No leaf-galls; few root-lice. Wilder (hybrid with *vinifera*—No leaf-galls; not many root-lice. Challenge (hybrid with *vinifera*)—No leaf-galls,

* Etude sur les divers Phylloxera, et leur médications.

roots affected but moderately. Diana—No leaf-galls, but plenty of root-lice.

V. vulpina (Southern Fox or Muscadine)—As it is not grown in this locality, being considered absolutely worthless here, I know little about it.

From this experience it would appear that no vines of those named, are entirely free from the attacks of the root-louse; but that the European varieties are most susceptible to it; the Northern Fox, next in order, the River Bank grape next, and the Summer grape being the least affected. It would likewise appear that galls are occasionally found on all of the species except the European, and as they have, in a few instances, been found on this species in Europe, it cannot be considered entirely exempt.* Nevertheless, in general terms, the River Bank grape must be considered the species which the gall-louse prefers. Experience on this point will, no doubt, vary in different parts of the country, and more extended experience may modify some of these deductions.

We thus see that no vine, whether native or foreign, is exempt from the attacks of the root-louse. Yet, on the principle that a small dose of poison may prove harmless or even beneficial where an over-dose will kill, we find that a small number of root-lice produce no serious effects upon a vine; and that it is only where they are very numerous, and cause not only the fibrous roots but even the larger ones to waste away, that their evil effects are perceptible. With most of our native vines when the conditions are normal, the disease seems to remain in the former mild state, and it is only with the foreign kinds, and with a few of the natives under certain conditions, that it takes on the more acute form.

In France, according to M. Laliman, the American varieties which have resisted the root-louse best are the Clinton, Taylor, Herbemont (known there as Warren), and some others which are considered valueless here, such as the Pauline, Elsimboro, Lenoir Mustang of Texas, and a kind of York-Madeira; while those which succumb are the Isabella, Scuppernong, Concord, Norton's Virginia, Maxatawney, Hartford Prolific, Cynthia, etc. This experience differs a little from ours, but shows that the Labruscas suffer most there also. — *To be continued.*

*Since this was written I have been informed by Mr. Glover of the Department of Agriculture, that the leaves of certain European vines, in green-house, such as *Muscat Hamburg* and *Madam Pince*, were crowded with the galls, even as late as December; and they had begun to spread on to the *Sonora* and the *Duc de Malacoff*.

REVIEWS AND BOOK NOTICES.

Catalogue of the Penguins in the Museum of the Boston Society of Natural History.* — We have in this brochure of 17 pages, the first of a series of papers on the magnificent collection of birds contained in the Museum of the Boston Society of Natural History — the second in size, in respect to number of species, in America. The collection is particularly important as containing the types of most of the species described by La Fresnaye, whose large collection of birds, gathered at a great expense, was purchased by the late Dr. Henry Bryant, and by him generously presented to the Society. It is the aim of the Society to eventually publish a complete catalogue of the birds in its Museum, in a series of papers, treating of the different groups in a more or less revisionary or monographic manner; and with this auspicious beginning it is to be hoped the work will be pushed rapidly forward. Prof. Hyatt briefly discusses the general affinities of the genera and species, and arrives at the conclusion that the larger part "come to a focus in *Spheniscus minor*, which appears to hold a strictly intermediate position, but presents a nearer approach to the lower members of the genera Pygocelis, Eudyptes and Aptenodytes than to any other existing form." He finds three modifications of the family "which presumably take place upon the basis of the organization of Spheniscus," diverging in radiating lines from *S. minor*, which is regarded as closely related to the "ancestral form." After some general remarks on the structure of the feathers and other features of the external anatomy, a somewhat detailed analysis of the genera is given, and also of the literature of the *Spheniscidæ*. The genera recognized are Aptenodytes, Spheniscus, Pygocelis and Eudyptes. The Society has specimens of nine species — apparently all but one or two of the known tenable species of the group. The synonymy is given only so far as to establish the names of the species, and give reference to one or two of the best published figures. Generally, remarks are added respecting the distinctive features of each, their peculiar changes and variations of plumage.

*Catalogue of the Ornithological Collection in the Museum of the Boston Society of Natural History. *I. Spheniscidæ*, by Alpheus Hyatt. With Notes on the Osteology of the Family, by Elliott Coues, M.D., U.S.A. Proc. Boston Soc. Nat. Hist., Vol. xiv, pp. 17. May, 1872. (Read May 17, 1871.)

Dr. Elliott Coues adds some highly important observations on the osteology of the family, and compares their more prominent skeletal modifications with those of the other groups of the Pygopodes. Any one of a large number of individual bones, he asserts, is of itself characteristic of the family. "A remarkable breadth and flatness of different bones," he observes, "is the dominant characteristic; it marks several bones that are cylindrical in all other birds and hollow in most;" and adds that "foremost among the diagnostic skeletal characters of the family comes the partly confluent condition of the metatarsals, which in all other existing birds are completely fused." The compound metatarsus "shows its composition in the two lengthened fenestræ that indicate the three original metatarsals;" and Dr. Coues suggests that "this may afford a useful hint in any search for the ancestral stock or primitive type of the *Spheniscidæ*;" yet one of these fenestræ is apparently common to many of the lower water birds; while the primitive distinctness of these bones is indicated by the medullary canals that are readily seen in a transverse section of the distal extremity of the metatarsals.

This carefully prepared paper, by Prof. Hyatt and Dr. Coues, is a welcome and valuable addition to our knowledge of this most interesting and by no means well-known group of birds.

NOTES ON THE NATURAL HISTORY OF FORT MACON, N. C., AND VICINITY.* — Under the above caption, we have a series of papers on the fauna and flora of the vicinity of Fort Macon, North Carolina, by Dr. Elliott Coues, based on two years' observation at that locality. The groups thus far fully reported upon are the Mammals, Birds and Reptiles among Vertebrates, the Crustacea, Radiata, and Mollusca, and also the Brachiopoda of the Annulata. The lists refer almost exclusively to the small island on which Fort Macon is situated, and to the waters immediately surrounding it, thus rendering the paper, by its restriction to a small area, of great value as the record of a local fauna.

The mammals observed number eighteen species, and incorporated with the list are various remarks relating to habits and external features, including about four pages respecting the opossum (*Didelphys Virginiana*). A wide range of individual variation in color, size and proportions of parts is pointed out, in connection

*Notes on the Natural History of Fort Macon, N. C., and Vicinity. By Elliott Coues. Proc. Acad. Nat. Sci. Phila., 1871, pp. 12-49, 120-148, May and July, 1871.

with which is discussed the affinities and alleged points of difference between the *D. Virginiana* of the East and the *D.* "*Californica*" of the West. The conclusion arrived at is that the two forms are specifically identical, — an opinion we had ourselves but a short time previously expressed.* Respecting their variations Dr. Coues thus remarks: "The more specimens I examined, the more I was struck with the variations that depend upon sex and age, as well as those that different individuals corresponding in these conditions present. An examination of these points, in the natural history of a single animal, may give results of general application; and yet in calling attention to the variability of the opossum, I do not wish to be understood as supposing that the animal is not as constant as many or most others, for I believe it to be no exception to a general standard or average in this respect. I doubt that one could study any mammal, as closely as I have the opossum, without being similarly impressed" (p.15). To the writer of the present notice, who has made individual variation in both mammals and birds a subject of special study for several years, this is cheering testimony, being corroborative of much that he had formerly to support almost alone.†

The list of birds embraces the names of one hundred and forty-two species, with quite extended notes on their habits, and memoranda of their times of arrival, breeding, departure, etc., rendering it highly satisfactory as a faunal list. There is also an extended notice (p. 34, foot note) of the pterylæ of *Rallus crepitans*.

A list of the reptiles concludes the first part, and numbers eleven species. No species of batrachian was noticed on the island, though several were observed on some of the neighboring islands, as well as on the adjoining main land.

Part II begins with an apparently nearly exhaustive list of the decapodous crustacea, part of which were obtained by dredging. Twenty-eight species are enumerated, and one cirriped and one entomostracan, accompanied by full notes respecting their relative abundance, habits and conditions of occurrence. Most of the species were determined by Prof. S. I. Smith, and the remainder by the late Dr. Wm. Stimpson, whose loss to science naturalists have so recently had cause to deplore. The Brachiopoda, next in

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* Bull. Mus. Comp. Zool., Vol. ii, p. 185, Apr., 1871.

† See Bull. Mus. Comp. Zool., Vol. i, No. 3 (Oct. 1869), and Vol. ii, Nos. 1 and 3 (Oct. 1870, and Apr., 1871).

order, consist of the single species, *Lingula pyramidata* Stimp., which was found in great numbers at a particular locality on the southern side of Bird Shoals.

The list of the Mollusca seems particularly full, upwards of one hundred and fifty species being enumerated, all but seven of which are marine. The marine species were referred for determination to Mr. Sanderson Smith, who has added various remarks respecting the peculiarities, etc., of the specimens examined. A portion of the species were obtained with the dredge, these being collected jointly by Drs. Coues and Packard and Prof. Morse, who together thus quite thoroughly explored every part of the harbor. Dr. Coues has added important notes respecting their several stations, abundance, etc., which add greatly to the value of the paper. While a few species obtained at this locality by Drs. Stimpson and Gill, in 1860, were not observed, some thirteen were added to Dr. Stimpson's list.

The partial list of the radiates collected embraces ten species, and the occurrence of nearly as many more, not fully identified, is indicated. Preceding the list of the mollusca is a quite detailed description of the locality explored, including the currents and shoals, with other interesting general remarks. An allusion to the changeableness of the locality recalls to us some interesting facts respecting the influence of sometimes single storms upon the fauna of some of our coast inlets. Some years since, a heavy westerly February gale depressed the water in a little bay off Orleans, Cape Cod, to such a degree that large portions of the flats usually covered at low water were laid bare, and remained so for a number of hours. The temperature at the time being in the vicinity of zero, F., a crust of ice formed over these exposed flats, which were at this time literally filled with living *Mya arenaria*, and the larger species of "razor-fish." A few years later, on visiting the locality, hardly a living specimen of either of these species could be found, but just beneath the surface the dead shells occurred in immense abundance, standing on end in their natural positions, the animals having been killed, undoubtedly, by the chilling consequent upon the exposure of the flats during the storm.

A similar destruction of molluscan life, but from another cause, came to our notice last summer (1871) near Great Salt Lake, Utah, where the water of Sulphur Springs Lake, near Salt Lake City, became so reduced in volume by evaporation as to kill all the

shells, through the excess of saline matter held in solution by the water. These shells embraced several species, which were abundantly represented. Such facts as these seem to explain the occurrence of beds of fossils under circumstances which show that they died from some sudden, though not very evident, cause.

Dr. Coues's paper forms a highly valuable contribution to the natural history of Beaufort harbor, and one that students of geographical zoology will heartily welcome. — J. A. A.

GIEBEL'S THESAURUS.* — Close upon the notable "Hand-list," of which we were lately called upon to speak, comes another general work of greater aims and claims. We have as yet only the first twenty-five signatures, constituting the first "halbband;" and we may sincerely say we wish it were necessary to wait for the whole, before judging the work, in the hope of some decided improvement becoming manifest. But as what we have in hand finishes the "Repertorium" and fairly opens the "Nomenclator," the character of the work is fully exposed. We had been led to expect great things of the *Thesaurus*, and opened it with perfect confidence: at the close of our examination — the longer protracted because our convictions became the more painfully prominent, and we were anxious to find ourselves in the wrong — we could not but regret that the fruits of such immense labor should be marred for lack of the *care* necessary for the compilation of works of reference. Dr. Giebel is sure of a storm of hostile criticism, that his work singularly invites if it does not actually enforce; for the simple reason that it is thoroughly unreliable. We have never seen a work of any considerable claims and merit, that more richly deserved the epithet "slovenly." It fairly bristles with misstatements; probably this whole number of the NATURALIST would not more than suffice to point out and correct them. The more's the pity, too, that this monument of laborious research should be defaced, not by lack of ability, not by erroneous opinions, not particularly by ignorance, but simply by carelessness. Yet, honey-combed with inaccuracy as it is, the work will, we are glad to say, become indispensable; it will find its place at the elbow of every working ornithologist; it represents too much hard work for any other result to be possible.

***Thesaurus Ornithologiæ*. Repertorium der gesammten ornithologischen literatur, und Nomenclator sämmtlicher gattungen und arten der vögel, nebst synonymen und geographischer verbreitung. Von *Dr. C. G. Giebel*, Professor an der Universität in Halle. In zwei Bänden oder vier Halbbänden. Leipzig: F. A. Brockhaus. 1872.

Of the "Nomenclator" we shall have nothing to say until it is finished, beyond the remark that this is of the nature of a dictionary, in which the genera are arranged alphabetically, those that Dr. Giebel considers synonymous being referred to what he considers to be a tenable name, the others being typographically distinguished; under the former being ranged alphabetically the species originally described by such name, under the latter those that the author regards as valid, each with its synonymy and geographical distribution. The "Repertorium" undertakes to be an index of ornithological literature from the earliest times to date. Probably those who are not specialists hardly realize what a mass of literature exists in every department of knowledge. Ornithology is one of the more circumscribed studies, hardly impinging on general affairs outside its agricultural and venatorial points of contact; yet its literature is, it seems, too voluminous to have ever been thoroughly digested. In the present work, we estimate that some seven thousand works and papers, relating wholly or in part to birds, are collated by title. Of just what this implies in the way of work, probably no one but the author himself has a very acute perception. That the list is a perfect index is not to be expected, and probably is not claimed; we could supply a number of titles ourselves, and of course better informed ornithologists could add many more; but it is certainly the nearest approach to a complete catalogue extant. The great trouble is, that the author has laboriously, ingeniously and successfully hidden away the individual titles by a remarkable system of enumerating them. They are arranged alphabetically according to authors' names, but under thirty-three separate headings. We cannot stop to enumerate these, but if our reader will try to think up as many different departments of ornithology, he will probably fail, and then a glance at the work will show how hopelessly the author has confused the subject and how completely he has defeated his aim. It is the exception, and not the rule, that any given paper falls distinctively under one of Dr. Giebel's headings; and the result is, that so far as we are personally concerned, we have no idea where to look for what we want, and doubtless our case is that of others. The location of a paper has been a matter of the author's tact in picking out its salient features, if it has any; and though he usually shows, we are glad to see, a happy knack in this regard, yet the very reverse is too often the case; and besides this, the numerous sheer

blunders are simply wonderful. For fair examples, picked up at random:—"Notice of a collection of Bird skins from Hayti," and "Ornithology of the Bermudas" are placed under Australia and Oceanica! "Ueber die Aptenodytes und Diomedeaarten *Süd-Georgiens*" under America septentrionalis! "List of birds, etc., of the District of Columbia" under America centralis! Finally, to endorse the words of a late reviewer, "misprints abound to such an extent, that the work reads not unlike first proofs just issued from the hands of a careless printer."

The defects of the work are glaring, and of the peculiarly exasperating nature that detains the most lenient critic against his will; but we must not allow them to blind us to the value of Dr. Giebel's labors, which they may overshadow but cannot eclipse. —E. C.

BOTANY.

Acclimatization of Plants.—In the "Archives des Sciences Physiques et Naturelles" of Geneva for June, Alph. De Candolle details a series of investigations of the question whether the habits of plants are changed by the action of the climate acting through a succession of generations. For this purpose he obtained seeds of plants which are widely dispersed over Europe from different localities, Edinburgh, Moscow, Montpellier and Palermo, and sowed them simultaneously and under similar conditions at Geneva. The general results of a somewhat limited series of experiments were that the seeds, obtained from the more northern localities, germinated on the whole somewhat earlier than those derived from more southern latitudes, and were also rather more rapid in arriving at maturity. The difference was still more observable in the second generation; but sufficient variation was shown in the seeds obtained from the same locality to make the results of but small value without a much larger series of observations.—A. W. B.

Effect of the Eruption of Vesuvius on Vegetation.—An interesting paper appears in the "Accademia delle Scienze Fisiche e Matematiche" of Naples, by G. A. Pasquale, on the effects of the recent eruption of Vesuvius on the plants in the neighborhood. The newest vegetation has suffered from contact with the ashes, though the effect has been neither a scorching nor drying up. The action has not been a mechanical one; for a mere closing of the

pores of the epidermis could not have caused death in so short a time. The closing of the pores and stomata is undoubtedly a secondary cause of death, but only after the lapse of some days. No change was observed similar to that produced by the vapor of boiling water. The scorching action of a high, dry temperature occurs only in the immediate vicinity of the volcano. Neither an acid nor alkaline reaction is shown by any change of color in the flowers or leaves, except a few instances of a change to blue of rose, orange, or violet colored organs, which might be attributed rather to an alkaline than an acid reaction; but these are few and doubtful. Many phenomena concur in pointing to chloride of sodium as the chief agent in the destruction of vegetable tissue. The salt was present in sufficient quantity in the falling ashes to be readily discernible to the sight, and is also met with as an efflorescence in the ashy soil. — A. W. B.

ZOOLOGY.

CALCULI FROM THE STOMACH OF A HORSE.— A singular and interesting collection of so-called "stones" was recently taken from the intestines of a horse in North Ferrisburg, Vermont. I did not see the animal, but am told that the largest calculus had broken through the large intestine, while the rest were lying loose in its cavity. There was in all, as nearly as I can ascertain, about a pint of the calculi, of which the largest and twelve other entire specimens are before me, and fragments of three or four others. Only the largest is regular in form. This is almost perfectly spherical, being nine and a quarter inches in circumference and 2.9453 inches in diameter, and its weight is eleven Troy ounces or 364.45 grammes. The rest are very much smaller and quite irregular in form, little less so than any chance handful of pebbles, and as they are smaller they are less regular. The larger two, excepting the large one just mentioned, though irregular, approach a spherical form with two opposite sides considerably flattened, the circumferences being respectively $2\frac{3}{4}$ inches and $2\frac{5}{8}$ inches in one direction and three inches and $2\frac{7}{8}$ inches in the other, and the diameters .93 and .96 inch for the longer and .63 and .68 inch for the shorter. The rest are all more or less inferior to these in size and approach a pyramidal form, the smallest being most definitely of this form with each side of a different size, the dis-

tance from the apex of each side to the middle of the opposite face being .25 inch, .375 inch and .46 inch.' The calculi are, in appearance, not unlike the common clay stones of the Connecticut River Valley though darker in color. They are composed of a series of concentric layers, which are quite a dark brown at the centre, but of lighter shades towards the outside, so that the color and appearance of the fractured surface is quite like the well known "Gibraltar Rock." The layers do not seem to differ in any other respect than depth of color. They are of somewhat variable thickness but for the most part they are from .01 inch to .03 inch and are much more distinct near the exterior than at the centre, where it is with difficulty that they are seen. The surface of all is smooth and polished and of a greenish brown color. The fracture is uneven and glassy. A chemical analysis of several by Mr Collier showed their composition to be somewhat peculiar, as they were found to be a triple phosphate of ammonia and magnesia with a little water and traces of lime and uric acid. All that were broken contained some foreign substance as a nucleus. In two instances this nucleus was a carpet tack, in the others a bit of stone. The specific gravity is 1.724 and the hardness somewhat less than calcite and rather more than selenite. The horse from which these objects were taken was sixteen years old and was sick only twenty-four hours before it died and, until the calculi were discovered, was supposed to have Bots. I am unable to find any mention of calculi as occurring in either stomach or intestines but I am told that similar ones to those described have been found in the stomach of the sheep in more than one instance, and Prof. Collier has handed me a fragment of one, which he says came from the stomach of a cow which when freshly broken has precisely the same appearance as those just described from the horse and is of nearly the same specific gravity, being 1.7049. If the mass, of which this piece is a fragment, was a perfect sphere, it must have been eighteen or nineteen inches in circumference.

The following table gives the dimensions and weight of ten of of the calculi :—

	Longest Diameter inches	Shortest Diameter inches	Weight in grains		Longest Diameter inches	Shortest Diameter inches	Weight in grains
No. 1.	2.94	2.94	5.025	No. 6.	.62	.43	40
" 2.	.96	.68	160	" 7.	.60	.44	30
" 3.	.93	.66	140	" 8.	.51	.32	23
" 4.	.68	.57	55	" 9.	.46	.38	20
" 5.	.63	.40	43	" 10.	.46	.25	15

Balls of hair very compact and smooth are of common occurrence in the stomachs of cattle, but stony concretions seem very rare. — G. H. PERKINS, *Burlington, Vermont.*

ANIMALS OF THE MAMMOTH CAVE. — [Since the account of the Blind fishes of the Mammoth Cave was published in the NATURALIST for January, 1872, I have accidentally met with the letter by Prof. B. Silliman, Jr., printed in the Amer. Jour. of Science, vol. ii, 2d series 1851, p. 332, giving an account of his visit to the cave in 1850. As there are several points of interest referred to in relation to the animals of the cave which I should have quoted in my article had I known of Prof. Silliman's at the time, I now make the following extract, especially calling attention to the statement relating to the fish *with color and external eyes*, in the hope that further information may be obtained about this otherwise unknown species. Is it the "black fish" of Tellkampf?

The account of the rat found in the cave and incapable of sight when first brought to the light, but afterwards attaining it, is of special interest in connection with the cause of blindness in the animals of the cave, and may be used as an argument that simple disuse of the organ of sight does not necessarily bring about atrophy of the eye, and that we must look to other than external conditions *for the cause* of the non-development of the eyes in many of the animals of the cave. — F. W. P.

"The phenomena of life within the cave are comparatively few but interesting. There are several insects, the largest of which is a sort of cricket with enormously long antennæ. Of this insect numerous specimens will be found among the specimens sent to Prof. Agassiz. There are several species of Coleoptera, mostly burrowing in the nitre earth. There are some small water-insects also which I suppose are Crustacean. Unfortunately, three vials containing numerous specimens of these insects were lost with my valise from the stage coach, and I fear will not be recovered. Of the fish, there are two species, one of which has been described by Dr. Wyman in the 'American Journal of Science,' and which is entirely eyeless; some ten or twelve specimens of the species were obtained. The second species of fish is not colorless like the first, and it has external eyes, which however are found to be quite blind. The craw-fish or small crustacea inhabiting the rivers with the fish are also eyeless and uncolored, but the larger-eyed and colored craw-fish, which are abundant without the cave, are also common at some seasons in the subterranean rivers, and so also it is said the fish of Green river are to be found in times of flood in the rivers of the cave. Among the collections are some

of the larger-eyed craw-fish which were caught by us in the cave. The only mammal, except the bats, observed in the cave, is a rat which is very abundant, judging from the tracks which they make, but so shy and secluded in their habits that they are seldom seen. We caught two of them, and fortunately male and female. The chief points of difference from the common rat in external characters, are in the color, which is bluish, the feet and belly and throat white, the coat which is of soft *fur* and the tail also thinly furred, while the common or Norway rat is gray or brown, and covered with rough hair. The cave rat is possessed of dark black eyes, of the size of a rabbit's eye and entirely without iris; the feelers also are uncommonly long. We have satisfied ourselves that he is entirely blind when first caught, although his eyes are so large and lustrous. By keeping them, however, in captivity and diffuse light, they gradually appeared to attain some power of vision. They feed on apples and bread, but will not at present touch animal food. There is no evidence that the cave rats ever visit the upper air, and there was no one who could tell me whether they were or were not found there by the persons who first entered this place in 1802. Bats are numerous in the avenues within a mile or two of the mouth of the cave, and Mr. Mantell thinks he has secured at least two species. Several specimens are preserved in alcohol. It was not yet quite late enough in the season when we were at the cave, Oct. 16th—22d, for all the bats to be in winter quarters, as the season was very open and warm. Still, in the galleries where they most abound, we found countless groups of them on the ceilings chippering and scolding for a foothold among each other. On one little patch of not over four by five inches, we counted forty bats, and were satisfied that one hundred and twenty, at least, were able to stand on a surface a foot square; for miles they are found in patches of various sizes, and a cursory glance satisfied us that it is quite safe to estimate them by millions. In these gloomy and silent regions where there is neither change of temperature nor difference of light to warn them of the revolving seasons, how do they know when to seek again the outer air when the winter is over and their long sleep is ended? Surely He who made them has not left them without a law for the government of their lives."

THE OPOSSUM.—This species of marsupial, seems to be widely distributed in every portion of the United States. Its original name in the Choctaw language is "shookhutta"; which signifies that he is the father or rather the originator of all hogs. It is not very swift of foot, neither is it very wild. I have frequently, when hunting in the woods, passed within a few steps of them and they did not seem to regard me. Our turkey buzzards have somehow found it out, and will alight near where they find the

opossum feeding in the woods and running up on him, flap their wings violently over him a few times, when the opossum goes into a spasm, and the buzzards very deliberately proceed to pick out its exposed eyes and generally take a pretty good bite from its neck and shoulders; the opossum lying on its side all the time and grunting. I have twice seen a buzzard do as described, and once I found a poor creature trying to find something to eat with one eye out and one shoulder entirely gone, evidently caused by a buzzard.

They dwell in hollow logs, stumps and in holes at the root of the trees. They do not burrow or prepare dens for themselves, but find such as are ready made. I have seen them carrying into their holes, at the approach of cold weather, considerable bundles of dry leaves rolled up in their tail; they understand the signs of the coming spells of bad weather, and they prepare for it by making for themselves a good warm bed. They do not hibernate, but are found out hunting food in frosty weather. They possess but little caution. Hence they are often found in the poultry houses, chicken coops, smoke houses, and even in our dining rooms, rattling about in search of something to eat. I have often seen their tracks in the roads and paths where they had travelled three or four miles to a farmyard, to which they had no doubt been directed by the crowing of the roosters. They will catch a grown hen and drag her off squalling at the top of her voice and will not abandon her until the dogs which have been aroused by the uproar have overtaken and commenced cracking their bones. They will eat bacon, dry beef, carrion, any kind of fowl, rabbits, any sort of small game, almost all the insects, and fruits of every variety. They voraciously devour the muskmelon, and several species of mushrooms; in short they are nearly omnivorous.

The only case in which it manifests any respectable degree of cautiousness is when it is hunted at night in the forest; on hearing the din and noise of the hunters, it with some difficulty makes shift to climb a small tree or sapling, where, wrapping the naked, rasplike tail around some convenient limb, it quietly awaits the approaching dogs and hunters. By many people the flesh is considered delicious. In Galveston, Texas, in the proper season, a good fat opossum will sell for $1.50. Its flavor resembles that of the flesh of a young hog, but is sweeter, less gross and is no doubt a more healthy food for man. A dog will starve sooner

than eat the flesh of an opossum; negroes and many other persons are exceedingly fond of it.

During their rutting season, the males are very rampant and belligerent. Numbers will collect around a female and fight like dogs. Twenty or thirty years ago, I witnessed a case myself in the forests of Mississippi. The female was present, there were three males, two of them were fighting, while the third was sitting off a little piece, looking as though he felt as if he had seen enough. They were fighting hard and had been, from the signs in the wallowed down grass, for three or four days. Kicking over the female, who immediately went into a spasm, I made a slight examination of the pouch.

They are exceedingly tenacious of life. I have many times seen the dogs catch them and chew and crack, seemingly, all the bones in the skin, leaving them to all appearances entirely lifeless; and, going out the next morning for the purpose of removing the dead thing, would find that it had left its death bed and putting the dogs on its track trail him a mile or more before overtaking him. He would, to be sure, be found in a bad fix, but at the same time he lacked two or three more bone crackings of being dead. They cannot, like the raccoon, be so far domesticated as to form any attachment for persons or their houses, though I have two or three times found them under the floor of dwelling houses, where they had been for some time and had evidently taken up winter quarters, but they did not remain there long, nor do I think they dwell long at any one place. They swim very well when it is necessary.— Gideon Lincecum, *Long Point, Texas.— Communicated by the Smithsonian Institution.*

Habits of Tropic Birds.—"For our own part, not believing in our queen Moé as implicitly as we ought to have done, we began shooting the tropic birds as they flew over us, but we soon gave it up, for two reasons:—first, that we found that if we got a rocketer, the chances were ten to one that we cut the scarlet feathers out of his tail; and, secondly, because we discovered that, by diligent peering under the bushes, we might pick up as many live uninjured specimens as we liked. I never saw birds tamer or stupider, which tameness or stupidity may be accounted for by the extreme smallness of their brain, which is really not larger than that of a sparrow. They sat and croaked, and pecked, and bit, but never

attempted to fly away. All you had to do was to take them up, pull the long red feather out of their sterns, and set them adrift again. Queen Moé was right. On Tubai you may pick up tropic birds as easily as a child picks up storm-worn shells on the sea-shore. It was really no small comfort to be able to get specimens of this beautiful bird without betraying their confidence by shooting them from the schooner. Small-brained as they are, they are gifted with an extraordinary amount of inquisitiveness, particularly in the early morning. As we bowl along before the flashing trade-wind, we hear a few harsh screams, and up come a pair of 'bosens' with their bright scarlet tail feathers glowing in the morning sun. They make two or three sweeps around us, evidently comparing notes, and then away into the deep blue, on their own private affairs. They fish generally like the tern, to whom I suspect they are cousins-german; but they have a way sometimes of hovering perpendicularly, with the bill pressed against the breast, that I have never observed but in one other bird, the black-and-white kingfisher of the Nile. When the 'bosen' has sighted his prey in this position, he turns over in the deftest manner, and goes down straight as a gannet, up to his neck, no further, and remounts for a fresh hover. I have never had the good fortune to see the white-tailed phaeton fishing, often as I have looked for him; indeed I have rarely met him out at sea at all. The finest I have seen were hanging about the high cliffs of the Society Islands; and I do not exaggerate when I state that I have seen more than one with a glorious waving white tail feather, two good feet long though the bird itself was not much larger than a black-headed gull. What they do with their tails when they feed passed my comprehension.

Not only did we find full-grown tropic birds, but we found their eggs and young,—the former about the size of a hen's egg, prettily splashed with reddish-brown, laid on the bare sand, under a bush; the latter really handsome creatures, about the size of a herring-gull, beautifully marked with black and white (like a falcon). The bill at this stage of their existence is black, not red. When you find your young friend under a bush, he is ensconced in a small basin of coral-dust, without any nest at all, and his surroundings show him to be a cleanly thing. When you come upon him suddenly, he squalls and croaks and wabbles about, and is as disconcerted as a warm city man when you try to drive a

new idea into him unconnected with money. But he sticks stoutly to his dusty cradle, and never attempts to escape, saying plainly enough, 'My mother told me to stop here till she brought me my supper; and here I am going to stay.'" — EARL OF PEMBROKE in *South-Sea Bubbles*, p. 143.— *Ann. and Mag. Nat. Hist.*

GEOGRAPHICAL VARIATION. — At the meeting of the Boston Society of Natural History on June 19, Mr. J. A. Allen made some further remarks on "Geographical Variation in North American Birds," a subject to which he had called the attention of the Society at a previous meeting, at which he exhibited specimens illustrating the general facts of geographical variation. He briefly referred to the smaller size, generally darker colors, larger beaks, longer claws and longer tails characterizing, as a general rule, individuals of the same species living at the southern borders of their respective habitats as compared with those living further northward, and the paler tints of those inhabiting the arid portions of the interior of the continent, as compared with those of the moister adjoining districts. He alluded to the changes of nomenclature that must naturally result from the now known intergradation of forms formerly regarded as specifically differentiated, such intergradation showing them to be geographical races and not species; and called attention to the coincidence of the occurrence of the brighter colored birds, not only as respects the avian class as a whole, but in respect to families and genera, within the tropical and subtropical regions, and also the occurrence within the same regions of all forms in which the bill or tail was remarkably developed; and finally passed to a consideration of the bearing of the general facts of geographical variation upon the question of the genesis of species. While admitting the laws of so-called natural and sexual selection to be potent influences in the differentiation of animals, he thought that they were secondary rather than primary agencies, and that the conditions of environment, and especially those of a geographical or climatic character, exercised a greater influence than evolutionists were generally willing to admit, and also that the "laws of acceleration and retardation," as shown by Professors Hyatt and Cope, were necessary to explain a certain class of phenomena presented by "modification by descent."

Although some of the modifications of color were undoubtedly

"protective," — the paler tints developed in dry regions better harmonizing with the pale gray tints of the vegetation at such localities, — yet the transition was as gradual over the intervening districts as were the climatic changes themselves over the same areas; while it was claimed that evidence of the direct influence of dry heated winds upon color was abundant; and that the gradual transition between diverse forms was so uniform and general that it pointed to constant and general laws of geographical variation. When the known transitional stages between formerly supposed specific forms were exceptional, it was more or less common to regard them as the result of hybridization, but the gradual, almost imperceptible, stages of transition between well-marked forms differently situated in respect to latitude rendered such a theory now highly untenable, and scarcely more probable as applied to intergrading forms occupying localities widely separated in respect to longitude. In regard to species as distinguished from varieties, it was deemed proper to regard as *species* such groups of individuals as did not at present intergrade, and as *varieties* such groups of individuals, though more or less diverse in their extreme phases, as were found to thoroughly intergrade, — which, he remarked, is only what many and probably the majority of naturalists are practically doing.

Note on the Thread Worm (*Filaria anhingæ*) Found in the Brain of the Snake Bird. — An account of this remarkable parasite was given in the "Proceedings of the Boston Society of Natural History" Oct. 7th, 1868, showing that it was present in seventeen out of nineteen birds examined, and always found in the same place, viz., the space between the cerebral lobes and the cerebellum. It was also shown that these worms are viviparous, their oviducts containing eggs in all stages of development from the egg just formed to the mature embryo. In the lower portions of the oviduct the young were hatched and ready for exclusion.

During the last winter, when in Florida, I had an opportunity, through the kindness of my friend G. A. Peabody, Esq., of examining ten additional birds. The proportion of the infected ones was less than in the previous examinations, no worms being found in four. Two of these were not mature birds, but of the age of the other two I have no record. Of the six in which worms were found, four had both male and female Filariæ, while two had only

females, viz., one had one and the other three. In the instances where both sexes were present, the eggs were found, as before, in various stages of development, while in the others, where females only existed, the oviducts were full of eggs and in the same numbers as in the others, but there were no signs of impregnation and consequently no developmental changes.

From these facts it seems almost certain that impregnation takes place in the head, and, unless both sexes are present there, the brood fails. It is also probable, on the supposition that these worms are migratory, that it is in the head of the Anhinga the sexual organs are developed, the young arriving there in an immature state.

Every attempt to find traces of this worm in other parts of the body, or even of the brain failed.—J. WYMAN.

VIVIPAROUS MINNOWS.—Specimens of a species of Pœcilia, found in some brackish lakes in the interior of the Island of New Providence, Bahamas, have been kept in an aquarium for the last three years. When first obtained they were about an inch long. The female grows in confinement to about double that length, and the male to something less, but is not one-half the bulk of his mate; both are semi-transparent and the backbone is clearly visible. The anal fin of the male consists principally of a long spine. In its normal position this spine lies close under the body and reaches backward nearly to the commencement of the caudal fin, and is evidently the intromittent organ. It is furnished with a hinge joint and is capable of being thrown forward at an acute angle, being also susceptible of a slight lateral movement. The act of copulation takes place by the male rising perpendicularly under and a little to one side of the female and making a dart at her with the spine, which is brought laterally forward at the instant of connection. The act is almost momentary and is hardly noticeable without the closest attention. Two of the females gave signs of being with young, and one morning a small fish about one-third of an inch long was discovered, but it was evident the rest had been devoured by the males, for on a subsequent occasion when a female again became gravid the males were all removed and on the next day the gravid fish had nine young, all born alive; these were placed together with the above mentioned *one* in a finger basin; they were perfect fish, and had no appearance of the yolk being attached, as is

the case with other fish. The day after their birth they ate raw beef shred very small. These ten fish are now nearly six months old and are all females; the two old ones have each had young since; one had three alive and four dead, the other four alive and four dead; neither of these latter broods lived over a month and were unable up to the time of their death to rise from the bottom of the aquarium. Between the birth of each litter there was a period of about ten weeks. Those which are alive are all females and the succeeding litters were to all appearances males. It will be a curious circumstance, and a subject for future investigation, should every alternate litter prove to be of an opposite sex to the preceding one. No fish have yet been bred from those born in the aquarium and therefore it is not known at what age they begin to reproduce. C. Fitz Gerald.—*Lieut. H. M., 1st W. India Regt., Nassau, Bahamas, March 11th, 1864.—Communicated by the Smithsonian Institution.*

MICROSCOPY.

Photo-mechanical Printing.—Incidentally to a pathological report to the Surgeon General, Dr. J. J. Woodward calls attention to the familiar disadvantages of the usual means of representing in publications the magnified appearance of microscopic objects by etchings, lithographs and woodcuts. All such hand work is laborious and wasteful of time if done by the investigator, and liable to omit the most important points if intrusted to another artist. Even the microscopist himself, being unable to represent all that he sees, is obliged to select what he conceives to be of importance, and thus represents his own theories rather than severe facts. [If, however, his theories are correct, and his delineation skilful, this very power of selection and construction enables him to give a distinctness and completeness which is lacked by the photographic camera.] The advantage of truthfulness is on the side of photo-micrography, but silver prints are expensive, inconvenient, and not permanent, and the reproduction of the negatives in permanent inks is greatly desired. Two such methods are now successfully used in the United States.

By the Woodbury method a relief surface of gelatine is produced from the negative by the action of light, and from this a metal "intaglio" is produced by pressure. In this a series of suitably colored gelatine films, which constitute the prints, are formed by

mechanical means. Thus was reproduced the photograph of *Amphipleura pellucida* in the last April number of this Journal.

In the Albertype process a printing surface (not a relief) is produced through the negative on a gelatine film by the action of light. The prints thus produced are, at present, less expensive than the Woodbury prints, and more convenient for book work, but the edition is less uniform. On enamelled paper the prints are handsomer, but will not bear much handling.

Lenses Dry or Immersion. — Dr. Thomas Birt writes to the "Monthly Microscopical Journal" an enthusiastic notice of a "new" $\frac{1}{5}$th by Ross, arranged to work wet or dry by screw collar adjustment and without change of front, a peculiarity shared only, as far as he (Dr. Birt) was informed, by Powell and Lealand's $\frac{1}{8}$th. If the Ross $\frac{1}{5}$th is like some other recent lenses by the same house, it would be difficult to say too much for its excellence as an objective: the one thing that could not be said of it is that it has any possible claim to priority in respect to the peculiarity mentioned.

This expedient, like that of double fronts, is undoubtedly an American innovation. Objectives with double fronts and with double backs were made by Tolles and by Wales years ago, and were taken to London and exhibited there in advance of any knowledge of such a contrivance there. Lenses to work either wet or dry, by cover adjustment only, have been so generally made and familiarly used in this country as to be not now looked upon as an innovation at all. The question of priority is possibly a difficult one, but both Wales and Tolles made and sold them freely, long before any claim to any such arrangement was made by any foreign maker. Wales, as early as August 1867, made two objectives of this kind, to work both wet and dry with the same front, and they were exhibited at the Fair of the American Institute in New York, and received a first premium medal and diploma bearing date of October 1867; he was advised to patent the improvement at the time, but did better than that, and certainly ought to be favorably remembered for having given it to us for nothing. Tolles also constructed these objectives about the same time, having made such an objective and delivered it to a purchaser as early as June 29th, 1868, and the objective of the above date is still in existence, and is considered one of the best that have yet been constructed on that plan by its maker.

Angular Aperture of Objectives. — In communications which have appeared in the Naturalist and in the "Monthly Microscopical Journal" of London, different writers have treated of the improvements made in the construction of apparatus, and especially of objectives, and have chosen their own method of expressing their ideas, and of commenting upon the expressed opinions of others; but where the end aimed at is truth, and the result sought for is an advance in the quality of appliances, minor matters and side issues in the controversies are to be overlooked.

All lovers of progress in scientific research feel much pleased with the labors of investigators who make good use of the extensive means at their control, as well as also with the results which have emanated from the patient thought and close study of such men as Mr. Wenham and others abroad. We are very apt, however, to give too little credit to the intelligent instrument maker himself. The mind which combines science with practice in its application has great advantages and should be both respected and encouraged.

How we have been forced to modify our opinions, since an angle of aperture of, say, 150° in microscopical objectives was considered absolutely unattainable! No doubt the very men who honestly and firmly believed those things impossible which are now quite familiar, were as glad as any one, when they became convinced, by facts, that they had been in error.

Equally gratified, probably, will be Mr. Wenham, when he shall see for himself that an angle of more than 82° can be attained through balsam. Within a few days, I have had a good opportunity to see a $\frac{1}{10}$th objective of Mr. Tolles' make give an angle of 92° through balsam with tank arrangement of Mr. Wenham. I feel disposed, however, to let Mr. Tolles speak of this in his own words, the more so as my time is extremely limited. — J. C.

Dr. Josiah Curtis, *Dear Sir:*—At my request, you were present recently when I measured the angular aperture of an immersion 1-10 in. objective when immersed in balsam. You verified the results gained at that time. We used the tank method of Mr. Wenham (see M. M. Journal, August, 1871).

The 1-10 in. tested, I stated to you, had in air angular ap. of 170° (upwards).

In water we found the angle to be 110°+.

In balsam the angle was fairly 95°, using petroleum lamp flame, thin, for light, in a darkened room. As you will remember I remarked that with sunlight I got two degrees more.

It will, I know, be of interest to you, and I am sure to some others, to hear of results of test of angle in some other cases. I will, therefore, set down here the angle of aper-

ture found to pertain to some of my immersion objectives in balsam, in water and in air.

	Air.	Air.	Water.	Balsam.
Single Front.	1-18 in.	170°	120°	87°
" "	1-18 in.	170°	110°	88°
Compound Front.	1-10 in.	175°	117°	95°
" "	1-13 in.	175°	105°	
" "	1-6 (high)	172°	108°	88°
Single "	1-5 in.	175°	127°	110°

The varying differences between the water and balsam angles can, in a general way, be accounted for from the formulas of construction differing considerably, each one from any other.

Of all these objectives the most effective (especially when its low power is considered) is the 1·5 in. of 110° *in balsam*. This is true of its use for objects mounted in balsam, as Rhomboides, *small*. But notably so as to its work on dry A. pellucida. My London specimen of this, received through the U. S. A. Medical Museum, is resolved into lines that *shine*, I may say. The illumination I used was petroleum lamp flame, no condensation. With the same means *all* the objectives show A. pellucida with the same illumination, but with a difference.

With sunlight and a blue cell no doubt the higher powers would have their proper advantage.

It is proper to mention that the 1-5 in. of 110° balsam angle was constructed on the plan proposed by me in the Lon. "Month. Micr. Jour." for March 1872, where I have made use of a diagram by Mr. Wenham of a 1-8 in. of his construction, to *indicate* modifications such as would give more than 81° or 82° in balsam.

With proper appliances below the balsam-slide (as pointed out by me in the Lon. Month. Micr. Jour., for July, 1871) we can with this objective (1-5 in.) utilize 110°, instead of about 81°, the limit of the amount of angle otherwise available. *In the first place* the large angle must have access to and through the balsamed object *from below;* in the next place the objective must be capable of receiving and transmitting that dimension of pencil to the eye, which thing previous to my own demonstrations has not been shown to have been done.

With much respect, yours truly,

BOSTON, July 8, 1872. ROBERT B. TOLLES.

ORGANISMS IN CROTON WATER.—Chas. F. Gissler's pamphlet on this subject can be obtained of the Naturalists' Agency, though not so stated on the title page. While microscopists generally are now approaching this question of water supply from a utilitarian direction, seeking hints of healthfulness or pestilence in the organisms they detect, the author looks upon the Croton with inquisitive eyes, deeming the water New Yorkers drink a charming field for chasing rotifers and crustaceans, water-bears and worms, and scarcely giving a thought to their dietetic value. As far as can be gathered, he judges them healthy enough, with some comparatively unimportant exceptions. The pamphlet contains some very attractive plates, which are well calculated to accomplish the author's avowed object, giving encouragement and popularity to this branch of microscopical study.

DISTRIBUTION AND ACTION OF NERVES.—Dr. L. S. Beale and Dr. E. Klein have contributed valuable papers on this subject to

the Royal Microscopical Society and to the Memoirs in the Quart. Journ. of Microscopical Science. Interesting incidental discussions may be found in the Proceedings of the Royal Microscopical Society in recent numbers of the Monthly Microscopical Journal.

Dr. Beale, in reporting his progress on this subject, offers no methods of investigation, different from those already published, but hopes for improvement in practical details, and consequently in results. He has demonstrated the distribution of nerve fibres to capillaries in nearly all the tissues of the frog, and is convinced of their similar arrangement in the higher animals. These delicate nerve fibres are seen to branch directly from the dark-bordered nerve fibres, and are often so close to the capillary as to be seen distinctly only when the vessel shrinks after death; and they may often run along on each side of the vessel, or form a plexus upon its surface. They may originate from ganglia or from sensitive and motor nerve trunks, and have intimate relations to some of the nerves of special sense, and to nerve fibres distributed to the voluntary muscles. They never, according to the author's observations, come into structural relation with the active elements of other tissues, notwithstanding the growing belief that they do so; and their influence is not dependent upon continuity of substance. The author is quite certain that muscular contraction may depend upon changes in a nerve running near the muscular fibre but distinctly separated from it. A nerve fibre often passes for some distance by the side of a cell and then is lost to view by passing behind it, or is hidden by a pigment cell, leading to the conclusion that the nerve fibre has become continuous with the substance of the cell. Such errors can be avoided only by studying extremely delicate specimens in a viscid fluid in which their position can be changed; hence the author's preference for glycerine as a medium for these investigations. A fine nerve fibre less than $\frac{1}{100000}$ of an inch in diameter may often be traced for a long distance, its edges being well defined, and nuclei occurring at certain intervals. These fibres, demonstrated by Dr. Beale ten years ago when their existence was not admitted, are believed by him to constitute the ultimate or terminal nerve networks or plexuses. He admits that these are sometimes, and probably always, compound fibres, but does not admit the existence of another plexus of far finer fibres as claimed by some other observers, preferring to discuss the bearing of what he has been able to

demonstrate in a variety of cases, rather than to reason upon the observations of others.

Dr. Klein, on the other hand, by modifying the common method of staining by chloride of gold, brings the finest nerve fibres into view so clearly that they can be easily studied with powers as low as 250 to 300. The cornea of a rabbit or guinea pig is very slightly stained with chloride of gold; and sections cut, with a razor, are examined in glycerine. Oblique and horizontal sections are examined, and the binocular microscope exhibits easily the relation of the different plexuses to each other. Only the nerve fibres are colored, but the cells of the epithelium are distinctly seen. Dr. Klein confidently claims to demonstrate non-nucleated nerve fibres far finer than the ultimate plexus of Dr. Beale. The latter observer admits that his ultimate fibres are compound and that the nuclei are somewhat to one side of the main fibre. Dr. Klein looks upon all nucleated nerve fibres as sheathed, the nuclei belonging to the sheath, and finds no nuclei in the finer and simpler fibres. By the carmine and glycerine method no more has been demonstrated than the plexus of nucleated non-medullate nerve fibres; but with the gold method the existence of non-nucleated nerve fibres among the epithelial cells is shown with certainty. The anatomical continuity of these with the larger nerve trunks can be positively seen.

Dr. Berkart agreed with Dr. Beale in throwing some doubt on the supposed influence of the nervous system on nutrition. Atrophy of the muscles, for instance, might be due directly to causes operating directly on the muscular tissue, though generally ascribed, at present, to the influence of the nerves. The influence of the nerves on secretion was, however, well established in many cases.

Dr. Murie regarded Dr. Beale's paper a rare and valuable contribution to microscopic anatomy. In the *rete mirabile* of the porpoise, we have vessels of considerable size supplied with nerves ramifying in a manner similar to those demonstrated on the capillaries by Dr. Beale in his minute dissections. The electrical organ of the torpedo has an arrangement of nerves, visible to the naked eye, much like that described as occurring in the mole's nose. If there was, in the remarkable fish referred to, "a vast electrical battery supplied by nervous influence of gigantic power, was it not very probable that the same kind of thing obtained in the arterial capillaries, modified of course to the limited exigencies

of their contractile powers?" He inclined to agree with Dr. Beale that nerves did not enter those epithelial tissues where the epithelium is continuously thrown off, as they would then be unfavorably exposed.

Mr. Stewart had examined Dr. Klein's specimens and was convinced of the "existence of a fine plexus of nerves between the cells of the conjunctival epithelium, directly continuous with the coarser plexus of nerves situated in the middle layer of the cornea." In reference to the close analogy between nerve force and electricity, and the influence of the former on the circulation, he instanced the fact that if an electric current be passed through a capillary tube filled with water, the water will flow out: electric currents also influenced the passage of fluids through dialyzing membranes.

Dr. Lawson thought that our views of microscopical anatomy had been very much advanced by Dr. Beale's paper. In experimenting on the effect of certain substances on the capillary circulation of the frog, he had always reached the results shown by Dr. Beale — "that the effect on the blood vessels was due entirely to the action of the nerves, and not to the influence of the substance employed in the experiment."

Mr. Hogg valued Dr. Beale's treatment of the nerves of the capillaries, because microscopists had not hitherto been able to discover any contractile power in the walls of the capillaries nor to settle the question of the cause of the circulation through the capillaries. Dr. Beale believed that the nerves acted rather on the muscular fibres than on the walls of the capillaries. He should think, however, that the action was directly upon the capillary vessels. In the cornea the nerves probably exist for the purpose of preventing the entrance of blood into its structure.

Dr. Leared thought Dr. Beale's views would throw some light on the question of sleep, and the action of such drugs as bromide of potassium, which probably exert their power by controlling the cerebral circulation.

Dr. Beale explained, and stated his adherence to, his former statement of doubt, whether the nerves acted directly on the capillaries or the elementary cells of secreting glands. He was also positive that the statement that the nuclei always belong to the sheath was a mistake, as in many of his specimens nuclei could be demonstrated in hosts of fine nerves, which came off from non-

medullated fibres. He claimed priority of discovery in many cases, where it had been awarded by Dr. Klein to the German histologists. Many details of structure were given in his elaborate drawings, which are not explained at length in the text, for English readers will not read long and minute descriptions of such things.

Crystalline Forms in Glass.—The beautiful fern-like clusters of acicular crystals which are liable to form in a vitreous mass slowly cooling, have been described by the "Monthly Microscopical Journal" and by "Science Gossip" as produced artificially in blowpipe beads and in porphyrine, and as occurring naturally in pitchstone. Such a crystallization often takes place as an accident in a mass of slowly cooling glass, as when, at glass works, the melted contents of a retort become accidentally ruined and they are allowed to cool and be thrown away. The crystals produced under such circumstances are generally confused and merely form opaque masses or layers in the brilliant glass; but sometimes, as in a beautiful mass kindly furnished to the writer by Mr. Harding of the glass works at Berkshire, Mass., the crystalline clusters form distinct stars or rosettes imbedded in perfectly clear glass and looking wonderfully like what almost every microscopist has wished he could make — snow-flakes perfectly and permanently preserved. The beauty of these objects is realized only when they are examined on a black field and by the binocular, and preferably by reflected light.

The Leucocytes.—Dr. J. G. Richardson's report to the American Medical Association, "On the Structure of the White Blood Corpuscles," was essentially a reassertion of the previously published doctrine of the identity of the white corpuscles of blood, pus and saliva. He is satisfied that they all act essentially alike in saline solutions, and that the salivary corpuscles are not only like white blood corpuscles distended by endosmosis when immersed in a fluid less dense than serum, but that they may, when acted upon by a dense saline solution, contract to the size of the white blood corpuscle and exhibit like amæboid movements. He also strongly insists upon the presence of a cell-wall, a question which loses much of its definiteness as well as its importance in view of the fact that the discussions of Dr. Beale have led many if not most investigators to the belief that the cell-wall, in general, is only an accident of age and circumstance, rather than an indispensable and

primary element of structure, from which we deduce that its presence may often be a question of degree rather than a question of absolute fact.

As water distends, and finally ruptures and destroys, the white blood corpuscles, it is suggested that in surgical operations, much less harm would be done to the living tissues by washing or sponging them with, instead of water, a solution of about fifty-five grains of salt to the pint of water.

Spontaneous Generation. — Dr. J. C. Dalton's very able lectures reviewing this subject, close with the reflection that now, as always, the idea of spontaneous generation is confined to those organisms of which we know least; obscurity commencing where our definite knowledge fails. Although such production would naturally exist, if at all, among the smallest and simplest organisms, still the imperfect organization of these minute forms may be only apparent, and there is every evidence that at least their regular and normal mode of production is from germs disseminated in the atmosphere. Hence they are to be regarded as cryptogamic vegetable organizations, with a definite place in the organic world.

NOTES.

At a meeting of the California Academy of Sciences, held June 5th, Mons. Octave Pavy, the Arctic explorer, was introduced by Dr. Stout, who also presented the letter of the American Geographical Society of New York, introducing and warmly commending the gentleman. Professor Davidson hoped to hear M. Pavy's views concerning the geography of the Polar regions. He announced that a great current, not marked on any of the charts, had been discovered off the northwest coast of the continent, and that only the present week he had received from Alaska complete confirmation of the discovery.

M. Pavy then addressed the Academy upon his projected expedition. He said he had no doubt of the existence of an Arctic passage from the Pacific to the Atlantic — though one that was of course impracticable for purposes of commerce. The speaker referred to the various expeditions from time to time sent out to explore the Polar regions. He said that since that of Sir John Ross, the routes of the expeditions had all been from the east of the American Continent. He (Pavy) was about to enter by a

passage hitherto untried. He believed that the Polar centre was an open sea in summer and winter, surrounded by a belt of ice, and that the great difficulty in reaching the Pole was the penetration of this belt. He believed this could be done by discovering the channel traversed by the warm ocean current from the South. There were six entrances to the Polar Basin—those eastward, between this continent, Greenland, Spitzbergen and Nova Zembla, were impracticable, because at a certain latitude powerful currents were encountered, sweeping down from the North and bringing ice with them, against which a ship could not be navigated. Through Behring's Strait, however, a warm current flowed to the North, and a clear passage through the ice-belt to the open sea must there be discovered. Dr. Kane had come to the conclusion that the ice-belt which had barred his progress in Smith's Sound, must have been the formation of not less than eighty years. All expeditions by the eastward had been stopped by impassable ice. The members of the Russian expedition, last year, had thought that they had reached the Polar Sea, but a comparison of their reckonings had shown that they had only entered a bight in the ice-belt created by the warmth of the Gulf Stream and already entered by navigators. The Gulf Stream, M. Pavy believed, sank as it expanded, and met the cold and heavy current from the North; but that it came to the surface again on reaching the Polar Sea; and retaining its heat unimpaired, maintained an open polar sea, and a moderate temperature at the Pole. In the latitude of 80° and southward of that, land birds were rarely known to stay, in consequence of the extreme cold; but they had been seen flying northward over the belt of ice; and in higher latitudes had been seen in great numbers. M. Pavy then traced on the chart the course which he intends to take. He said that passing through Behring's Strait he would take a direction to the northeast, reaching Wrangle's Land north of the coast of Siberia. This land he believed to be a continent stretching away toward the Pole, and reaching into the milder climate which he expected to find. In 1812 the Russian Government had started an expedition to explore Wrangle's Land. Several attempts were made to cross it by sleighing over the ice, but on each occasion they were baffled by the ice becoming thinner as they went farther north, until they came to open water. The great eastern ocean current, flowing upward through Behring's Strait, and rounding the shores of this

unexplored continent, Wrangle's Land, whirled eastward into the Polar basin. Then uniting with the waters of the Gulf Stream, the southern currents were formed which swept through the straits leading into Baffin's Bay and down upon the shores of Spitzbergen and Nova Zembla. The woods common to the shores of Siberia were found strewn upon the coasts of these islands, and confirmed the theory. A portion of the great Japan current branched off, M. Pavy said, to the south of Alaska, and produced the fine climate, enjoyed along this coast. Another evidence of an open polar sea, to the north of the ice-belt, was the fact that one species of whale, commonly passed northward at the approach of winter, seeking clear water and avoiding the perils of a frozen surface. M. Pavy said he expected to reach Wrangle's Land by the 1st of September, and would occupy the time from that date until May 1873, in crossing northward by means of sledges and dogs, over the continent, which he supposes Wrangle's Land to be. On reaching the open sea, he will abandon his sledges, turn his dogs loose, and launch the India rubber raft, which he takes with him, set sail, and steer for the axle of the earth. Having achieved the triumph of reaching it, he will shape his course by that of the great polar currents, and steer southeast for Cape Alexander, passing through Smith's Sound, down Baffin's Bay, and out into the Atlantic Ocean.

Professor Davidson opposed some of M. Pavy's theories. He said that he would as soon expect to find an ice-cream mountain in Africa as a warm Polar basin. He said that his own Arctic explorations had shown a different state of facts concerning the direction of the currents, than that assumed by M. Pavy. The Gulf Stream, he believed, flowed northward between the shores of Greenland, Spitzbergen and Nova Zembla, and, rounding the Polar Sea, flowed southward again through the straits leading into Baffin's Bay. He denied, also, that there was any reason to believe Wrangle's Land to be a continent. He cited instances in which the "false horizons" of northern latitudes, had caused erroneous observations to be taken by explorers. He considered the latest European charts of the Arctic regions, approached through Behring's Strait, erroneous in important particulars. He thought that M. Pavy would meet with more difficulties than he had anticipated. He said that M. Pavy had greatly over-estimated the magnitude and effect of the current as it passed through

Behring's Strait. "Knowing the size of a dog's throat it is easy to tell what he can swallow." Behring's Strait is twenty-five miles wide, and has an average depth of twenty-five fathoms. The rate of the current is from one and a half to three knots an hour. The current, therefore, must be of little account, and entirely inadequate to produce the effect attributed to it by M. Pavy. Still Professor Davidson felt sure that the expedition would result in great benefits to the cause of science, and he was only sorry that M. Pavy had decided to return by the Atlantic instead of by the Pacific.

[To show the diversity of opinion that exists in relation to this subject, we copy the following from the Proceedings of the Royal Geographical Society of April 22d, as given in "Nature."—EDS.]

"On Recent Explorations of the North Polar Region, by Captain Sherard Osborn, R. N. Captain Osborn commenced by alluding to his advocacy of a Polar Expedition *via* Smith Sound in 1865, and stated that the Duke of Somerset, then First Lord of the Admiralty, though apparently sufficiently favorable to the general proposal of a Government Expedition, urged upon him by a deputation from the Society who waited on him in that year, declined to assume the responsibility of recommending an expedition, owing to the difference of opinion which then reigned with regard to the best route to be followed. The alternate route to Smith Sound was that by the seas of Spitzbergen, advocated by Dr. Petermann and others, on the ground that the Gulf Stream, flowing in that direction, maintained an open sea to the Pole. He (Captain Osborn) and the promoters of the Expedition were content to wait the result of efforts made soon after by the Swedes and Germans to carry out the views of the German geographer. Seven years had elapsed, and we were now in a position to say that the advocates of the Spitzbergen route had been proved entirely wrong, whilst those who believed Smith Sound to be the best route were right. Captain Koldeway, who commanded both the German Expeditions, states, as the result of all his efforts, that "one can hardly resist the conviction that the hope of attaining the North Pole by ship, or of finding an open sea around the Pole, are alike among the most improbable of things. I confess that I myself was misled by representations in Dr. Petermann's 'Geographische Mittheilungen,' and held it to be at least possible by following a line of coast, to penetrate by ship far into the central Arctic region, and then certainly to make one's way to the Pole. A winter in East Greenland, the most careful observation of these mighty masses of ice, their movements and formation, and of the whole condition of temperature, have radically cured me, and all

my companions of this idea. . . . If the principal object be the nearest possible approach to the Pole, I am quite of Osborn's opinion that the best way appears to be through Smith Sound. Here one can penetrate to the 78th parallel, and then one has a continuous line of coast running north, which has been sighted as far as the 82nd parallel. Along this coast one would have to work one's way in spring with dog-sledges. I consider it a wild undertaking to penetrate towards the Pole by ship between Spitzbergen and Nova Zembla." No one could undo the effect of evidence so honest and conclusive as this. The Duke of Somerset rested his decision to delay action on the importance of first being furnished with the results of the Swedish Expedition then on its way to Spitzbergen. The Swedes during the last seven or eight years had sent no less than four expeditions to the verge of the Polar region; and the conclusion of their scientific leader, Von Nordenskiöld, is that in summer it is not possible to penetrate by ship through the pack, and that an open Polar Sea is a mere hypothesis destitute of foundation. The Swedish authorities further state that the only way to approach the Pole is that proposed by the English Arctic officers, of exploring on sledges in the spring. Here, then, are the results for which the First Lord of the Admiralty in 1865 desired to wait. After a review of the voyage of the Austrian Lieutenants Payer and Weyprecht last summer, in which they found open sea a little to the north and west of Nova Zembla, and which discovery is to be followed up by a second expedition in the present summer, Capt. Osborn concluded by an eloquent appeal to the English people not to allow the final laurels of Polar discovery to be wrung from them by the sailors or explorers of any other nation. In the discussion which followed, Dr. J. D. Hooker spoke of the important questions in the science of botany which a North Polar Expedition alone could elucidate; such as the extension nearer the Pole of fossil plants like those of Disco in Greenland, which indicate a former temperate climate in 70° north. Dr. Carpenter advocated a Polar Expedition as a necessary complement to the one the Government were about to dispatch to the Pacific to investigate the deep-sea ocean currents, and so forth. Accurate investigations of current-temperature, etc., of the Polar Ocean were of the highest importance to the right comprehension of the true theory of oceanic movements. Admiral Sir George Back stated that he entirely approved of the Smith Sound route as the one best to be adopted for a North Polar Expedition. Sir Leopold M'Clintock also spoke to similar effect. Admiral Richards explained the interest attaching to the completion of the geography of Greenland, which ought to be achieved by the English. He was strongly of opinion that a Government expedition, and by the English, was alone competent to finish the work of Arctic discovery. Mr. R. H. Scott read a letter from Von Nordenskiöld, in which he stated that a Swedish expedition would start for

Spitzbergen this summer, winter in the islands to the north, and attempt a journey towards the Pole in May, 1873, with reindeer-sledges.

THE HASSLER EXPEDITION.— Here we are north of the equator again. We arrived at this port on the 25th, all well. We have touched at many places along the western coast of South America. At Payta, the last place on the coast before going to the Galapagos Islands, a large collection was made considering the time we remained there, and among the fishes were two specimens, male and female, of a Cestracion; these we also found at the Galapagos. All the collections we had on board at that time were sent to New York by the U. S. S. Ossipee which sailed the same day we did. We left Payta on the 6th inst, sailing directly for Galapagos arriving there on the 10th inst. We anchored the first night in Post Office Bay, a little haven on the north side of Charles Island which is one of the most southern of the group. After leaving Charles Island, we stopped at Albermarle, James, Jervis and Indefatigable Islands, collecting more or less at every stopping place. Our collection at the Galapagos is very satisfactory, being very large, and includes, in fish, fifty-two species. We found in great quantities the two large species of Amblarhynchus, so accurately described in Darwin's "Voyage," etc., and obtained some thirty of each species. Some of the land species were three or four feet long and one weighed thirteen pounds. We have twenty-five birds' skins and many birds in alcohol, three seals' skins and a number of skulls. Jervis Island seemed to be quite an extensive seal rookery and we saw hundreds of land seals on the shore. They were very tame, thus giving us a favorable opportunity to study them. There was one family group on the beach which we looked at as long a time as we pleased, being only a few feet from them. The mother appeared not to be alarmed as long as we did not touch her two young ones: they were walking about on all fours like a dog, their hind and fore feet bent forward. We found inhabitants (seven persons) only on Charles Island, of those we visited, although other islands are inhabited. We left the Islands on the 19th, making nine days' stay.— J. HENRY BLAKE, *Panama*, June 30th. [Since the receipt of this letter, Count Pourtales has returned to Cambridge, and we understand that Professor Agassiz and other members of the Expedition will soon return home by the way of San Francisco.— EDS.]

ANSWERS TO CORRESPONDENTS.

L. M., Norwich, Conn. — The singular moth found on the cucumber vine is the *Ægeria cucurbitæ* of Harris.

E. M. B., Templeton, Mass. — The plant is *Marchantia polymorpha*, one of the Hepaticæ, or liverworts.

C. W., Wethersfield, Conn. — The chrysalis in the stem of the currant is that of the common Currant Borer (*Trochilium tipuliforme* Linn.) — an importation from Europe. It is, of course, necessary that the larvæ of *Nematus ventricosus* should undergo their last moult before they can become pupæ. — C. V. R.

— —, Lonsdale, R. I. The insect sent is *Corydulus cornutus*, noticed p. 436, Vol. i, of the NATURALIST.

EXCHANGES.

Pollen of Passiflora, and various **Poduræ** offered in exchange for Microscopic specimens. — SWAN M. BURNETT, M.D., *Knoxville, Tenn.*

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a pilgrimage across the continent. I have sought and viewed in their native haunts many a plant and flower which for me had long bloomed unseen, or only in the *hortus siccus*. I have been able to see for myself what species and what forms constitute the main features of the vegetation of each successive region, and record—as the vegetation unerringly does—the permanent characteristics of its climate.

Passing on from the eastern district, marked by its equably distributed rainfall, and therefore naturally forest-clad, I have seen the trees diminish in number, give place to wide prairies, restrict their growth to the borders of streams, and then disappear from the boundless drier plains; have seen grassy plains change into a brown and sere desert—desert in the common sense, but hardly anywhere botanically so; have seen a fair growth of coniferous trees adorning the more favored slopes of a mountain range high enough to compel summer showers; have traversed that broad and bare elevated region shut off on both sides by high mountains from the moisture supplied by either ocean, and longitudinally intersected by sierras which seemingly remain as naked as they were born; and have reached at length the westward slopes of the high mountain barrier which, refreshed by the Pacific, bears the noble forests of the Sierra Nevada and the Coast Range, and among them trees which are the wonder of the world. As I stood in their shade, in the groves of Mariposa and Calaveras, and again under the canopy of the commoner Redwood, raised on columns of such majestic height and ample girth, it occurred to me that I could not do better than to share with you, upon this occasion, some of the thoughts which possessed my mind. In their development they may, perhaps, lead us up to questions of considerable scientific interest.

I shall not detain you with any remarks (which would now be trite) upon the size or longevity of these far-famed Sequoia trees, or of the sugar pines, incense-cedar and firs associated with them, of which even the prodigious bulk of the dominating Sequoia does not sensibly diminish the grandeur. Although no account and no photographic representation of either species of the far-famed Sequoia trees gives any adequate impression of their singular majesty—still less of their beauty—yet my interest in them did not culminate merely or mainly in considerations of their size and age. Other trees, in other parts of the world, may claim to be

older. Certain Australian gum trees (Eucalypti) are said to be taller. Some, we are told, rise so high that they might even cast a flicker of shadow upon the summit of the pyramid of Cheops. Yet the oldest of them doubtless grew from seed which was shed long after the names of the pyramid builders had been forgotten. So far as we can judge from the actual counting of the layers of several trees, no Sequoia now alive can sensibly antedate the Christian era.

Nor was I much impressed with an attraction of man's adding. That the more remarkable of these trees should bear distinguishing appellations seems proper enough: but the tablets of personal names which are affixed to many of them in the most visited groves,—as if the memory of more or less notable people of our day might be made more enduring by the juxtaposition,—do suggest some incongruity. When we consider that a hand's breadth at the circumference of any one of the venerable trunks so placarded has recorded in annual lines the lifetime of the individual thus associated with it, one may question whether the next hand's breadth may not measure the fame of some of the names thus ticketed for adventitious immortality. Whether it be the man or the tree that is honored in the connection, probably either would live as long, in fact and in memory, without it.

One notable thing about these Sequoia trees is their *isolation*. Most of the trees associated with them are of peculiar species, and some of them are nearly as local. Yet every pine, fir, and cypress in California is in some sort familiar, because it has near relatives in other parts of the world. But the redwoods have none. The redwood—including in that name the two species of "big-trees" —belongs to the general cypress family, but is *sui generis*. Thus isolated systematically, and extremely isolated geographically, and so wonderful in size and port, they more than other trees suggest questions.

Were they created thus local and lonely, denizens of California only; one in limited numbers in a few choice spots on the Sierra Nevada, the other along the coast range from the Bay of Monterey to the frontiers of Oregon? Are they veritable Melchizedecs, without pedigree or early relationship, and possibly fated to be without descent?

Or are they now coming upon the stage (or rather were they coming but for man's interference) to play a part in the future?

Or, are they remnants, sole and scanty survivors of a race that has played a grander part in the past, but is now verging to extinction? Have they had a career, and can that career be ascertained or surmised, so that we may at least guess whence they came, and how, and when?

Time was, and not long ago, when such questions as these were regarded as useless and vain,—when students of natural history, unmindful of what the name denotes, were content with a knowledge of things as they now are, but gave little heed as to how they came to be so. Now, such questions are held to be legitimate, and perhaps not wholly unanswerable. It cannot now be said that these trees inhabit their present restricted areas simply because they are there placed in the climate and soil of all the world most congenial to them. These must indeed be congenial, or they would not survive. But when we see how Australian Eucalyptus trees thrive upon the Californian coast, and how these very redwoods flourish upon another continent; how the so-called wild oat (*Avena sterilis* of the Old World) has taken full possession of California; how that cattle and horses, introduced by the Spaniard, have spread as widely and made themselves as much at home on the plains of La Plata as on those of Tartary, and that the cardoon-thistle seeds, and others they brought with them, have multiplied there into numbers probably much exceeding those extant in their native lands; indeed, when we contemplate our own race, and our own particular stock, taking such recent but dominating possession of this New World; when we consider how the indigenous flora of islands generally succumbs to the foreigners which come in the train of man; and that most weeds (*i. e.*, the prepotent plants in open soil) of all temperate climates are not "to the manor born," but are self-invited intruders;—we must needs abandon the notion of any primordial and absolute adaptation of plants and animals to their habitats, which may stand in lieu of explanation, and so preclude our inquiring any further. The harmony of Nature and its admirable perfection need not be regarded as inflexible and changeless. Nor need Nature be likened to a statue, or a cast in rigid bronze, but rather to an organism, with play and adaptability of parts, and life and even soul informing the whole. Under the former view Nature would be "the faultless monster which the world ne'er saw," but inscrutable as the Sphinx, whom it were vain, or worse, to question of the whence and whither.

Under the other, the perfection of nature, if relative, is multifarious and ever renewed; and much that is enigmatical now may find explanation in some record of the past.

That the two species of redwood we are contemplating originated as they are and where they are, and for the part they are now playing, is, to say the least, not a scientific supposition, nor in any sense a probable one. Nor is it more likely that they are destined to play a conspicuous part in the future, or that they would have done so, even if the Indian's fires and the white man's axe had spared them. The redwood of the coast (*Sequoia sempervirens*) had the stronger hold upon existence, forming as it did large forests throughout a narrow belt about three hundred miles in length, and being so tenacious of life that every large stump sprouts into a copse. But it does not pass the Bay of Monterey, nor cross the line of Oregon, although so grandly developed not far below it. The more remarkable *Sequoia gigantea* of the Sierra exists in numbers so limited that the separate groves may be reckoned upon the fingers, and the trees of most of them have been counted, except near their southern limit, where they are said to be more copious. A species limited in individuals holds its existence by a precarious tenure; and this has a foothold only in a few sheltered spots, of a happy mean in temperature and locally favored with moisture in summer. Even there, for some reason or other, the pines with which they are associated (*Pinus Lambertiana* and *P. ponderosa*), the firs (*Abies grandis* and *A. amabilis*) and even the incense-cedar (*Libocedrus decurrens*) possess a great advantage, and, though they strive in vain to emulate their size, wholly overpower the Sequoias in numbers. "To him that hath shall be given." The force of numbers eventually wins. At least in the commonly visited groves *Sequoia gigantea* is invested in its last stronghold, can neither advance into more exposed positions above, nor fall back into drier and barer ground below, nor hold its own in the long run where it is, under present conditions; and a little further drying of the climate, which must once have been much moister than now, would precipitate its doom. Whatever the individual longevity, certain if not speedy is the decline of a race in which a high death-rate afflicts the young. Seedlings of the big trees occur not rarely, indeed, but in meagre proportion to those of associated trees; and small indeed is the chance that any of these will attain to "the days of the years of their fathers."

"Few and evil" are the days of all the forest likely to be, while man, both barbarian and civilized, torments them with fires, fatal at once to seedlings, and at length to the aged also. The forests of California, proud as the State may be of them, are already too scanty and insufficient for her uses. Two lines, such as may be drawn with one sweep of a small brush over the map, would cover them all. The coast redwood,—the most important tree in California,—although a million times more numerous than its relative of the Sierra, is too good to live long. Such is its value for lumber and its accessibility, that, judging the future by the past, it is not likely, in its primeval growth, to outlast its rarer fellow-species.

Happily man preserves and disseminates as well as destroys. The species will probably be indefinitely preserved to science, and for ornamental and other uses, in its own and other lands; and the more remarkable individuals of the present day are likely to be sedulously cared for, all the more so as they become scarce.

Our third question remains to be answered: Have these famous Sequoias played in former times and upon a larger stage a more imposing part, of which the present is but the epilogue? We cannot gaze high up the huge and venerable trunks, which one crosses the continent to behold, without wishing that these patriarchs of the grove were able, like the long-lived antediluvians of scripture, to hand down to us, through a few generations, the traditions of centuries, and so tell us somewhat of the history of their race. Fifteen hundred annual layers have been counted, or satisfactorily made out, upon one or two fallen trunks. It is probable that close to the heart of some of the living trees may be found the circle that records the year of our Saviour's nativity. A few generations of such trees might carry the history a long way back. But the ground they stand upon, and the marks of very recent geological change and vicissitude in the region around, testify that not very many such generations can have flourished just there, at least in an unbroken series. When their site was covered by glaciers, these Sequoias must have occupied other stations, if, as there is reason to believe, they then existed in the land.

I have said that the redwoods have no near relatives in the country of their abode, and none of their genus anywhere else. Perhaps something may be learned of their genealogy by inquiring of such relatives as they have. There are only two of any partic-

ular nearness of kin; and they are far away. One is the bald cypress, our southern cypress, Taxodium, inhabiting the swamps of the Atlantic coast from Maryland to Texas, thence extending into Mexico. It is well known as one of the largest trees of our Atlantic forest-district, and, although it never (except perhaps in Mexico, and in rare instances) attains the portliness of its western relatives, yet it may equal them in longevity. The other relative is Glyptostrobus, a sort of modified Taxodium, being about as much like our bald cypress as one species of redwood is like the other.

Now species of the same type, especially when few, and the type peculiar, are, in a general way, associated geographically, *i. e.*, inhabit the same country, or (in a large sense) the same region. Where it is not so, where near relatives are separated, there is usually something to be explained. Here is an instance. These four trees, sole representatives of their tribe, dwell almost in three separate quarters of the world: the two redwoods in California, the bald cypress in Atlantic North America, its near relative, Glyptostrobus, in China.

It was not always so. In the tertiary period, the geological botanists assure us, our own very Taxodium, or bald cypress, and a Glyptostrobus, exceedingly like the present Chinese tree, and more than one Sequoia, co-existed in a fourth quarter of the globe, *viz.*, in Europe! This brings up the question: Is it possible to bridge over these four wide intervals of space and the much vaster interval of time, so as to bring these extraordinarily separated relatives into connection. The evidence which may be brought to bear upon this question is various and widely scattered. I bespeak your patience while I endeavor to bring together, in an abstract, the most important points of it.

Some interesting facts may come out by comparing generally the botany of the three remote regions, each of which is the sole home of one of these three genera, *i. e.*, Sequoia in California, Taxodium in the Atlantic United States, and Glyptostrobus in China, which compose the whole of the peculiar tribe under consideration.

Note then, first, that there is another set of three or four peculiar trees, in this case of the yew family, which has just the same peculiar distribution, and which therefore may have the same explanation, whatever that explanation be. The genus Torreya, which commemorates our botanical Nestor and a former president of

this association, Dr. Torrey, was founded upon a tree rather lately discovered (that is, about thirty-five years ago) in northern Florida. It is a noble, yew-like tree, and very local, being known only for a few miles along the shores of a single river. It seems as if it had somehow been crowded down out of the Alleghanies into its present limited southern quarters; for in cultivation it evinces a northern hardiness. Now another species of Torreya is a characteristic tree of Japan; and the same, or one very like it indeed, inhabits the Himalayas, — belongs, therefore, to the Eastern Asiatic temperate region, of which China is a part, and Japan, as we shall see, the portion most interesting to us. There is only one more species of Torreya, and that is a companion of the redwoods in California. It is the tree locally known under the name of the California nutmeg. In this case the three are near brethren, species of the same genus, known nowhere else than in these three habitats.

Moreover, the Torreya of Florida has growing with it a yew tree; and the trees of that grove are the only yew trees of Eastern America; for the yew of our northern woods is a decumbent shrub. The only other yew trees in America grow with the redwoods and the other Torreya in California, and more plentifully farther north, in Oregon. A yew tree equally accompanies the Torreya of Japan and the Himalayas, and this is apparently the same as the common yew of Europe.

So we have three groups of trees of the great coniferous order which agree in this peculiar geographical distribution; the redwoods and their relatives, which differ widely enough to be termed a different genus in each region; the Torreyas, more nearly akin, merely a different species in each region; the yews, perhaps all of the same species, perhaps not quite that, for opinions differ and can hardly be brought to any decisive test. The yews of the Old World, from Japan to Western Europe, are considered the same; the very local one in Florida is slightly different; that of California and Oregon differs a very little more; but all of them are within the limits of variation of many a species. However that may be, it appears to me that these several instances all raise the same question, only with a different degree of emphasis, and, if to be explained at all, will have the same kind of explanation. But the value of the explanation will be in proportion to the number of facts it will explain.

Continuing the comparison between the three regions with which

we are concerned, we note that each has its own species of pines, firs, larches, etc., and of a few deciduous-leaved trees, such as oaks and maples; all of which have no peculiar significance for the present purpose, because they are of genera which are common all round the northern hemisphere. Leaving these out of view, the noticeable point is that the vegetation of California is most strikingly unlike that of the Atlantic United States. They possess some plants, and some peculiarly American plants in common,—enough to show, as I imagine, that the difficulty was not in the getting from the one district to the other, or into both from a common source, but in abiding there. The primordially unbroken forest of Atlantic North America, nourished by rainfall distributed throughout the year, is widely separated from the western region of sparse and discontinuous tree-belts of the same latitude on the western side of the continent, where summer rain is wanting or nearly so, by immense treeless plains and plateaux of more or less aridity, traversed by longitudinal mountain ranges of a similar character. Their nearest approach is at the north, in the latitude of Lake Superior, where, on a more rainy line, trees of the Atlantic forest and that of Oregon may be said to interchange. The change of species and of the aspect of vegetation in crossing, say on the forty-seventh parallel, is slight in comparison with that on the thirty-seventh or near it. Confining our attention to the lower latitude, and under the exceptions already specially noted, we may say that almost every characteristic form in the vegetation of the Atlantic States is wanting in California, and the characteristic plants and trees of California are wanting here.

California has no Magnolia nor tulip trees, nor star-anise tree; no so-called Papaw (Asimina); no barberry of the common single-leaved sort; no Podophyllum or other of the peculiar associated genera; no Nelumbo nor white water-lily; no prickly ash nor sumach; no loblolly-bay nor Stuartia; no basswood nor linden trees; neither locust, honey-locust, coffee trees (Gymnocladus) nor yellow-wood (Cladrastis); nothing answering to Hydrangea or witch-hazel, to gum-trees (Nyssa and Liquidambar), Viburnum or Diervilla; it has few asters and golden-rods; no lobelias; no huckleberries and hardly any blueberries; no Epigæa, charm of our earliest eastern spring, tempering an icy April wind with a delicious wild fragrance; no Kalmia nor Clethra, nor holly, nor persimmon; no Catalpa tree, nor trumpet-creeper (Tecoma); nothing answering to

sassafras, nor to benzoin tree, nor to hickory; neither mulberry nor elm; no beech, true chestnut, hornbeam, nor ironwood, nor a proper birch tree; and the enumeration might be continued very much further by naming herbaceous plants and others familiar only to botanists.

In their place California is filled with plants of other types, trees, shrubs and herbs, of which I will only remark that they are, with one or two exceptions, as different from the plants of the eastern Asiatic region with which we are concerned (Japan, China and Mandchuria), as they are from those of Atlantic North America. Their near relatives, when they have any in other lands, are mostly southward, on the Mexican plateau, or many as far south as Chili. The same may be said of the plants of the intervening great plains, except that northward and in the subsaline vegetation there are some close alliances with the flora of the steppes of Siberia. And along the crests of high mountain ranges the arctic-alpine flora has sent southward more or less numerous representatives through the whole length of the country.

If we now compare, as to their flora generally, the Atlantic United States with Japan, Mandchuria, and Northern China, *i. e.*, Eastern North America with Eastern North Asia — half the earth's circumference apart — we find an astonishing similarity. The larger part of the genera of our own region, which I have enumerated as wanting in California, are present in Japan or Mandchuria, along with many other peculiar plants, divided between the two. There are plants enough of the one region which have no representatives in the other. There are types which appear to have reached the Atlantic States from the south; and there is a larger infusion of subtropical Asiatic types into temperate China and Japan; among these there is no relationship between the two countries to speak of. There are also, as I have already said, no small number of genera and some species which, being common all round or partly round the northern temperate zone, have no special significance because of their occurrence in these two antipodal floras, although they have testimony to bear upon the general question of geographical distribution. The point to be remarked is, that many or even most of the genera and species which are peculiar to North America as compared with Europe, and largely peculiar to Atlantic North America as compared with the Californian region, are also represented in Japan and Mandchuria, either

by identical or by closely similar forms! The same rule holds on a more northward line, although not so strikingly. If we compare the plants, say of New England and Pennsylvania (lat. 45°–47°), with those of Oregon, and then with those of northeastern Asia, we shall find many of our own curiously repeated in the latter, while only a small number of them can be traced along the route even so far as the western slope of the Rocky Mountains. And these repetitions of East American types in Japan and neighboring districts are in all degrees of likeness. Sometimes the one is undistinguishable from the other; sometimes there is a difference of aspect, but hardly of tangible character; sometimes the two would be termed marked varieties if they grew naturally in the same forest or in the same region; sometimes they are what the botanist calls representative species, the one answering closely to the other, but with some differences regarded as specific; sometimes the two are merely of the same genus, or not quite that, but of a single or very few species in each country; when the point which interests us is, that this peculiar limited type should occur in two antipodal places, and nowhere else.

It would be tedious, and except to botanists abstruse, to enumerate instances; yet the whole strength of the case depends upon the number of such instances. I propose, therefore, if the Association does me the honor to print this discourse, to append in a note, a list of the more remarkable ones. But I would here mention two or three cases as specimens.

Our *Rhus Toxicodendron*, or poison ivy, is very exactly repeated in Japan, but is found in no other part of the world, although a species much like it abounds in California. Our other poisonous *Rhus* (*R. venenata*), commonly called poison dogwood, is in no way represented in Western America, but has so close an analogue in Japan that the two were taken for the same by Thunberg and Linnæus, who called them both *R. Vernix*.

Our northern fox-grape, *Vitis Labrusca*, is wholly confined to the Atlantic States, except that it reappears in Japan and that region.

The original Wistaria is a woody leguminous climber with showy blossoms, native to the Middle Atlantic States; the other species, which we so much prize in cultivation, *W. Sinensis* is from China, as its name denotes, or perhaps only from Japan, where it is certainly indigenous.

Our yellow-wood (Cladrastis) inhabits a very limited district on the western slope of the Alleghanies. Its only and very near relative, Maackia, is in Mandchuria.

The Hydrangeas have some species in our Alleghany region; all the rest belong to the Chino-Japanese region and its continuation westward. The same may be said of Philadelphus, except that there are one or two mostly very similar species in California and Oregon.

Our blue cohosh (Caulophyllum) is confined to the woods of the Atlantic States, but has lately been discovered in Japan. A peculiar relative of it, Diphylleia, confined to the higher Alleghanies, is also repeated in Japan, with a slight difference, so that it may barely be distinguished as another species. Another relative is our twin-leaf (Jeffersonia) of the Alleghany region alone; a second species has lately turned up in Mandchuria. A relative of this is Podophyllum, our mandrake, a common inhabitant of the Atlantic United States, but found nowhere else. There is one other species of it, and that is in the Himalayas. Here are four most peculiar genera of one family, each of a single species in the Atlantic United States, which are duplicated on the other side of the world, either in identical or almost identical species, or in an analogous species, while nothing else of the kind is known in any other part of the world.

I ought not to omit ginseng, the root so prized by the Chinese, which they obtained from their northern provinces and Mandchuria, and which is now known to inhabit Corea and Northern Japan. The Jesuit Fathers identified the plant in Canada and the Atlantic States, brought over the Chinese name by which we know it, and established the trade in it, which was for many years most profitable. The exportation of ginseng to China probably has not yet entirely ceased. Whether the Asiatic and the Atlantic American ginsengs are exactly of the same species or not is somewhat uncertain, but they are hardly, if at all, distinguishable.

There is a shrub, Elliottia, which is so rare and local that it is known only at two stations on the Savannah River, in Georgia. It is of peculiar structure, and was without near relative until one was lately discovered in Japan (Tripetaleia), so like it as hardly to be distinguishable except by having the parts of the blossom in threes instead of fours, — a difference which is not uncommon in the same genus, or even in the same species.

Suppose Elliottia had happened to be collected only once, a good while ago, and all knowledge of the limited and obscure locality were lost; and meanwhile the Japanese form came to be known. Such a case would be parallel with an actual one. A specimen of a peculiar plant (*Shortia galacifolia*) was detected in the herbarium of the elder Michaux, who collected it (as his autograph ticket shows) somewhere in the high Alleghany Mountains, more than eighty years ago. No one has seen the living plant since or knows where to find it, if haply it still flourishes in some secluded spot. At length it is found in Japan; and I had the satisfaction of making the identification.* One other relative is also known in Japan; and another, still unpublished, has just been detected in Thibet.

Whether the Japanese and the Alleghanian plants are exactly the same or not, it needs complete specimens of the two to settle. So far as we know they are just alike, and even if some difference were discerned between them, it would not appreciably alter the question as to how such a result came to pass. Each and every one of the analogous cases I have been detailing — and very many more could be mentioned — raises the same question, and would be satisfied with the same answer.

These singular relations attracted my curiosity early in the course of my botanical studies, when comparatively few of them were known, and my serious attention in later years, when I had numerous and new Japanese plants to study in the collections made (by Messrs. Williams and Morrow) during Commodore Perry's visit in 1853, and, especially, by Mr. Charles Wright, in Commodore Rodgers' expedition in 1855. I then discussed this subject somewhat fully, and tabulated the facts within my reach.†

This was before Heer had developed the rich fossil botany of the Arctic zone, before the immense antiquity of existing species of plants was recognized, and before the publication of Darwin's now famous volume on the "Origin of Species" had introduced and familiarized the scientific world with those now current ideas respecting the history and vicissitudes of species with which I attempted to deal in a moderate and feeble way.

My speculation was based upon the former glaciation of the northern temperate zone, and the inference of a warmer period

* Amer. Jour. Science, 1867, p. 402; Proceed. Amer. Acad., 8, p. 244.
† Mem. Amer. Acad. vol 6.

preceding and perhaps following. I considered that our own present vegetation, or its proximate ancestry, must have occupied the arctic and subarctic regions in pliocene times, and that it had been gradually pushed southward as the temperature lowered and the glaciation advanced, even beyond its present habitation; that plants of the same stock and kindred, probably ranging round the arctic zone as the present arctic species do, made their forced migration southward upon widely different longitudes, and receded more or less as the climate grew warmer; that the general difference of climate which marks the eastern and the western sides of the continents,— the one extreme, the other mean — was doubtless even then established, so that the same species and the same sorts of species would be likely to secure and retain foothold in the similar climates of Japan and the Atlantic United States, but not in intermediate regions of different distribution of heat and moisture; so that different species of the same genus, as in Torreya, or different genera of the same group, as redwood, Taxodium and Glyptostrobus, or different associations of forest trees, might establish themselves each in the region best suited to its particular requirements, while they would fail to do so in any other. These views implied that the sources of our actual vegetation and the explanation of these peculiarities were to be sought in, and presupposed, an ancestry in pliocene or still earlier times, occupying the high northern regions. And it was thought that the occurrence of peculiarly North American genera in Europe in the tertiary period (such as Taxodium, Carya, Liquidambar, Sassafras, Negundo, etc.), might be best explained on the assumption of early interchange and diffusion through North Asia, rather than by that of the fabled Atlantis.

The hypothesis supposed a gradual modification of species in different directions under altering conditions, at least to the extent of producing varieties, subspecies and representative species, as they may be variously regarded; likewise the single and local origination of each type, which is now almost universally taken for granted.

The remarkable facts in regard to the Eastern American and Asiatic floras which these speculations were to explain, have since increased in number, more especially through the admirable collections of Dr. Maximowitz in Japan and adjacent countries, and the critical comparisons he has made and is still engaged upon.

I am bound to state that, in a recent general work * by a distinguished European botanist, Prof. Grisebach of Göttingen, these facts have been emptied of all special significance, and the relations between the Japanese and the Atlantic United States floras declared to be no more intimate than might be expected from the situation, climate, and present opportunity of interchange. This extraordinary conclusion is reached by regarding as distinct species all the plants common to both countries between which any differences have been discerned, although such differences would probably count for little if the two inhabited the same country, thus transferring many of my list of identical to that of representative species; and, then, by simply eliminating from consideration the whole array of representative species, *i. e.*, all cases in which the Japanese and the American plant are not exactly alike. As if, by pronouncing the cabalistic word *species* the question were settled, or rather the greater part of it remanded out of the domain of science;—as if, while complete identity of forms implied community of origin, anything short of it carried no presumption of the kind; so leaving all these singular duplicates to be wondered at, indeed, but wholly beyond the reach of inquiry!

Now the only known cause of such likeness is inheritance; and as all transmission of likeness is with some difference in individuals, and as changed conditions have resulted, as is well known, in very considerable differences, it seems to me that, if the high antiquity of our actual vegetation could be rendered probable, not to say certain, and the former habitation of any of our species or of very near relatives of them in high northern regions could be ascertained, my whole case would be made out. The needful facts, of which I was ignorant when my essay was published, have now been for some years made known,—thanks, mainly, to the researches of Heer upon ample collections of arctic fossil plants. These are confirmed and extended by new investigations, by Heer and Lesquereux, the results of which have been indicated to me by the latter.

The Taxodium, which everywhere abounds in the miocene formations in Europe, has been specially identified, first by Gœppert, then by Heer, with our common cypress of the Southern States. It has been found, fossil, in Spitzbergen, Greenland and Alaska,

* Die Vegetation der Erde nach ihrer klimatischen Anordnung. 1871.

— in the latter country along with the remains of another form, distinguishable, but very like the common species; and this has been identified by Lesquereux in the miocene of the Rocky Mountains. So there is one species of tree which has come down essentially unchanged from the tertiary period, which for a long while inhabited both Europe and North America, and also, at some part of the period, the region which geographically connects the two (once doubtless much more closely than now), but has survived only in the Atlantic United States and Mexico.

The same Sequoia which abounds in the same miocene formations in Northern Europe has been abundantly found in those of Iceland, Spitzbergen, Greenland, Mackenzie River and Alaska. It is named *S. Langsdorfii*, but is pronounced to be very much like *S. sempervirens*, our living redwood of the Californian coast, and to be the ancient representative of it. Fossil specimens of a similar, if not the same, species have recently been detected in the Rocky Mountains by Hayden, and determined by our eminent palæontological botanist, Lesquereux; and he assures me that he has the common redwood itself from Oregon in a deposit of tertiary age. Another *Sequoia* (*S. Sternbergii*) discovered in miocene deposits in Greenland, is pronounced to be the representative of *S. gigantea*, the big tree of the Californian Sierra. If the Taxodium of the tertiary time in Europe and throughout the Arctic regions is the ancestor of our present bald cypress,— which is assumed in regarding them as specifically identical, — then I think we may, with our present light, fairly assume that the two redwoods of California are the direct or collateral descendants of the two ancient species which so closely resemble them.

The forests of the Arctic zone in tertiary times contained at least three other species of Sequoia, as determined by their remains, one of which, from Spitzbergen, also much resembles the common redwood of California. Another, "which appears to have been the commonest coniferous tree on Disco," was common in England and some other parts of Europe. So the Sequoias, now remarkable for their restricted station and numbers, as well as for their extraordinary size, are of an ancient stock; their ancestors and kindred formed a large part of the forests which flourished throughout the polar regions, now desolate and ice-clad, and which extended into low latitudes in Europe. On this continent one species, at least, had reached to the vicinity of its present habitat

before the glaciation of the region. Among the fossil specimens already found in California, but which our trustworthy palæontological botanist has not yet had time to examine, we may expect to find evidence of the early arrival of these two redwoods upon the ground which they now, after much vicissitude, scantily occupy.

Differences of climate, or circumstances of migration, or both, must have determined the survival of Sequoia upon the Pacific, and of Taxodium upon the Atlantic coast. And still the redwoods will not stand in the east, nor could our Taxodium find a congenial station in California.

As to the remaining near relative of Sequoia, the Chinese Glyptostrobus, a species of it, and its veritable representative, was contemporaneous with Sequoia and Taxodium, not only in temperate Europe, but throughout the Arctic regions from Greenland to Alaska. Very similar would seem to have been the fate of a more familiar gymnospermous tree, the Gingko or Salisburia. It is now indigenous to Japan only. Its ancestor, as we may fairly call it, since, according to Heer, "it corresponds so entirely with the living species that it can scarcely be separated from it," once inhabited Northern Europe, and the whole Arctic region round to Alaska, and had even a representative farther south, in our Rocky Mountain district. For some reason, this and Glyptostrobus survived only on the shores of Eastern Asia.

Libocedrus, on the other hand, appears to have cast in its lot with the Sequoias. Two species, according to Heer, were with them in Spitzbergen. Of the two now living, *L. decurrens*, the incense-cedar, is one of the noblest associates of the present redwoods; the other is far south in the Andes of Chili.

The genealogy of the Torreyas is more obscure; yet it is not unlikely that the yew-like trees, named Taxites, which flourished with the Sequoias in the tertiary Arctic forests, are the remote ancestors of the three species of Torreya, now severally in Florida, in California, and in Japan.

As to the pines and firs, these were more numerously associated with the ancient Sequoias of the polar forests than with their present representatives, but in different species, apparently more like those of Eastern than of Western North America. They must have encircled the polar zone then, as they encircle the present temperate zone now.

I must refrain from all enumeration of the angiospermous or ordinary deciduous trees and shrubs, which are now known, by their fossil remains, to have flourished throughout the polar regions when Greenland better deserved its name and enjoyed the present climate of New England and New Jersey. Then Greenland and the rest of the north abounded with oaks, representing the several groups of species which now inhabit both our eastern and western forest districts; several poplars, one very like our balsam poplar, or balm of Gilead tree; more beeches than there are now, a hornbeam, and a hop-hornbeam, some birches, a persimmon, and a planer-tree, near representatives of those of the Old World, at least of Asia, as well as of Atlantic North America, but all wanting in California; one Juglans like the walnut of the Old World, and another like our black walnut; two or three grapevines, one near our Southern fox grape or Muscadine, another near our Northern frost grape; a Tilia, very like our basswood of the Atlantic States only; a Liquidambar; a Magnolia, which recalls our *M. grandiflora;* a Liriodendron, sole representative of our tulip-tree; and a sassafras, very like the living tree.

Most of these, it will be noticed, have their nearest or their only living representatives in the Atlantic States, and when elsewhere, mainly in Eastern Asia. Several of them, or of species like them, have been detected in our tertiary deposits, west of the Mississippi, by Newberry and Lesquereux.

Herbaceous plants, as it happens, are rarely preserved in a fossil state, else they would probably supply additional testimony to the antiquity of our existing vegetation, its wide diffusion over the northern and now frigid zone, and its enforced migrations under changes of climate.

Concluding, then, as we must, that our existing vegetation is a continuation of that of the tertiary period, may we suppose that it absolutely originated then? Evidently not. The preceding cretaceous period has furnished to Carruthers in Europe a fossil fruit like that of the *Sequoia gigantea* of the famous groves, associated with pines of the same character as those that accompany the present tree; has furnished to Heer, from Greenland, two more Sequoias, one of them identical with a tertiary species, and one nearly allied to *Sequoia Langsdorfii*, which in turn is a probable ancestor of the common Californian redwood; has furnished to Lesquereux in North America the remains of another ancient

Sequoia, a Glyptostrobus, a Liquidambar which well represents our sweet-gum tree, oaks analogous to living ones, leaves of a plane-tree, which are also in the tertiary and are scarcely distinguishable from our own *Platanus occidentalis*, of a magnolia and tulip-tree, and "of a sassafras undistinguishable from our living species." I need not continue the enumeration. Suffice it to say that the facts justify the conclusion which Lesquereux—a very scrupulous investigator—has already announced: "that the essential types of our actual flora are marked in the cretaceous period, and have come to us after passing, without notable changes, through the tertiary formations of our continent."

According to these views, as regards plants at least, the adaptation to successive times and changed conditions has been maintained, not by absolute renewals, but by gradual modifications. I, for one, cannot doubt that the present existing species are the lineal successors of those that garnished the earth in the old time before them, and that they were as well adapted to their surroundings then, as those which flourish and bloom around us are to their conditions now. Order and exquisite adaptation did not wait for man's coming, nor were they ever stereotyped. Organic nature—by which I mean the system and totality of living things, and their adaptation to each other and to the world—with all its apparent and indeed real stability, should be likened, not to the ocean, which varies only by tidal oscillations from a fixed level to which it is always returning, but rather to a river, so vast that we can neither discern its shores nor reach its sources, whose onward flow is not less actual because too slow to be observed by the *ephemeræ* which hover over its surface, or are borne upon its bosom.

Such ideas as these, though still repugnant to some, and not long since to many, have so possessed the minds of the naturalists of the present day, that hardly a discourse can be pronounced or an investigation prosecuted without reference to them. I suppose that the views here taken are little, if at all, in advance of the average scientific mind of the day. I cannot regard them as less noble than those which they are succeeding.

An able philosophical writer, Miss Frances Power Cobbe, has recently and truthfully said:*

* Darwinism in Morals; in Theological Review, April, 1871.

"It is a singular fact, that when we can find out how anything is done, our first conclusion seems to be that God did not do it. No matter how wonderful, how beautiful, how intimately complex and delicate has been the machinery which has worked, perhaps for centuries, perhaps for millions of ages, to bring about some beneficent result, if we can but catch a glimpse of the wheels its divine character disappears."

I agree with the writer that this first conclusion is premature and unworthy; I will add deplorable. Through what faults or infirmities of dogmatism on the one hand and skepticism on the other it came to be so thought, we need not here consider. Let us hope, and I confidently expect, that it is not to last;—that the religious faith which survived without a shock the notion of the fixity of the earth itself, may equally outlast the notion of the absolute fixity of the species which inhabit it;—that, in the future even more than in the past, faith in an *order*, which is the basis of science, will not (as it cannot reasonably) be dissevered from faith in an *Ordainer*, which is the basis of religion.

THE WHITE COFFEE-LEAF MINER.

[Concluded from June number, p. 341.]

BY B. PICKMAN MANN.

Abundance.— Some idea of the abundance of these insects may be given by stating that, although, as I was frequently told, they were much less destructive than usual during the year in which I observed them, yet from one tree, which I chose for an experiment as not exceptional unless by reason of its size, I picked one hundred and fifty-three leaves in the course of nineteen minutes, endeavoring at the same time to select only those leaves which contained living larvæ, and to leave those from which the larvæ had escaped. Of these leaves forty-four contained recent mines, but the larvæ had escaped; ninety contained one hundred and twenty-two mines still inhabited; the rest contained old mines or blotches made by a fungus which also attacks the leaves.

Manner of Devastation.—The injury caused by this insect is due to the destruction of the digestive and respiratory organs of

the plant. The larva "absorbs the sap, obstructs the circulatory channels, and impedes the vegetable respiration" (Madinier, l. c. p. 33), thus depriving the plant of its food, or preventing the food from becoming fit to sustain life, in consequence of which the plant becomes exhausted, and either dies, or bears fewer and smaller fruit.

Amount of Devastation. — Guérin says (Mém. etc. p. 12; [Dumeril, Rapp.,] p. 33) that in the Antilles "all the coffee-trees were feeble and languishing: they bore only small and stunted fruits, their leaves were spotted or blackened, in [great] part dried up, and although dead, remaining upon the branches, * * which rendered these shrubs languishing, and had even caused the death of many of them." Madinier says (l. c. p. 33) that owing to the attacks of insects, of which this is the most noxious, the culture of the coffee-tree was abandoned in the island of Martinique. This insect is said to lessen the coffee-crop of Brazil by at least one-fifth.

Enemies: Fungus.—The leaves of the coffee-tree sometimes turn yellow at the tip or some portion of the edge. The spots thus formed increase in size until they cover the whole leaf, gradually turning to a brown color, by which time the leaf has become dried up. These spots may be easily distinguished from those made by the larva, because the two skins of the leaf which is attacked by this disease cannot be separated, and the color is more uniform, appearing equally on both surfaces of the leaf. I was told that this was the work of a fungus. It attacks leaves which have or have not been injured by the larva, but seems to find more ready lodgment on such part of the leaf as has been injured previously. It appears in these cases to kill the larva within the mine, as many mines recently begun are found to contain the flat and empty skin of the larva, with no indication of another destroyer, but I may have been misled in my judgment by seeing the interrupted labor of the Eulophus of which I will speak next.

Enemies: Parasites. — I have found two ichneumons parasitic upon the insect: one upon the larva, the other upon the pupa. I have also found great numbers of mites (Acarina) living in the mines. The first of these ichneumons, which feeds upon the larva of *Cemiostoma coffeellum*, was found several times under a small roundish blotch of a grayish-brown color (about the same in color as the fungus-spot), which was dotted with black dots, as

if a lichen had grown upon it. These black dots may have been the frass of the larva, which showed through the epidermis.

Where the ichneumon had escaped from these dotted blotches, it had cut out an oval or rounded hole in the upper surface of the blotch. Once, before I broke open one of these mines from which the ichneumon had escaped, I found the pupa-skin *in situ*, with its broken end just touching the hole, through which it could be seen. The hole was about 0·2 millimeter in diameter.

I found several of these blotches which had no hole in them, and yet I found no ichneumon within, but the larva-skin flat and empty. This led me to think that the fungus which I have mentioned may kill and exhaust some larvæ.

According to Ratzeburg (Ichneumonen der Forstinsecten, i, (1844), p. 158), this ichneumon belongs to the genus Eulophus, in the family of *Chalcididæ*. I have not been able to make a satisfactory figure of it, owing to the injured condition of the only three examples which I succeeded in preserving. It may be called *Eulophus cemiostomatis*, if it has not been previously described.

The imago is metallic green or coppery; the wings are transparent, somewhat iridescent; the fore wings crossed by a brownish cloud beyond the middle. The fore wings have no other vein than a double one near the front margin, which is bent at about one-quarter, and ends in a fork at about three-quarters of the distance between the base and the tip, sending one prong of the fork in line with the vein, and the other towards the inner angle of the wing. The inner margin of the fore wing is also thickened for a short distance near the middle; and the front margin of the hind wing is thickened along more than half its length from the base. All the wings are fringed around their margins, and the wings as well as the different parts of the body and legs are pubescent. The antennæ are eight-jointed, thinly haired; the first joint long, enlarged at the apex; the last three joints forming an ovate-conical club; the intermediate four joints ovate-cylindrical. The abdomen is elongate-oval, attached to the thorax by a broad neck, and is turned up at the sides. The tarsi are four-jointed. The length of the head and body is about 0·8 millimeter, the expanse of wings about 1·5 millimeters.

The pupa when seen through the pupa-skin seems to be longer than the imagos.—The pupa-skins look large; all are alike; one or two were sufficiently transparent to allow the occu-

pant to be seen, which was much narrower than the pupa-skin. From one pupa-skin I hatched one of these ichneumons. I found them during all the time (April to June) in which I studied the Cemiostoma. In the one hundred and fifty-three leaves mentioned I found eight mines containing these insects. Afterwards I obtained two from a box containing leaves.

The second ichneumon parasitic on the *Cemiostoma coffeellum*, inhabits the larva while it is still in the mine, as I learned by finding an immature example dead within the thin and dried skin of a nearly full-grown larva, but I believe that it usually does

Fig. 130.

Bracon Parasite of the Coffee Moth.

not kill its victim until after the Leaf-miner has become a pupa. It then completes its work of destruction and cuts a hole in the upper side of the cocoon, through which it escapes.

It belongs to that subfamily of the ichneumons called *Braconidæ;* consequently I will call it *Bracon letifer;* but as far as I have examined its characters, it corresponds more nearly to the genus Rogas than to any other genus described in Curtis' "British Entomology," and seems to be congeneric with, and judging by the venation of the wings, nearly related to *Exothecus exsertor*, as given in Wesmael's "Monographie des Braconides de Belgique" in the Nouvelles Mémoires de l'Academie de Bruxelles, xi (1838), p. 73, and accompanying plate, fig. 10.

The perfect insect (Fig. 130) is honey yellow, except the eyes, ocelli, and sometimes the ocellar space, which are black. The antennæ are also black, and consist of twelve slender, sub-equal, uniformly cylindrical joints beyond the scape, which seems to consist of two short, stout joints, making fourteen in all. The head is transverse; the front projects slightly beyond the eyes; the hind margin of the vertex is emarginate, the emargination filled with the upper edge of the occiput. The three ocelli are arranged triangularly; in some examples they are approximate, in others distant, which may be a sexual difference. The neck is distinct; the back of the mesothorax sub-hexagonal, rounded, tapering anteriorly. In some of my examples the abdomen is elongate, subclavate; in others it is rotundate. I think the shape given in the figure is the most lifelike. In some examples the veins near the extremity of the wings are very feebly developed. The wings are fringed. The legs, abdomen, thorax, head, antennæ and wings are pubescent. Length 1·9 millimeters; expanse 4·7 millimeters. The immature example, or pupa of the *Bracon*, which I found as stated above, had wing pads instead of wings. These were dark, smoky black, 0·5 millimeter long. The antennæ are honey yellow, instead of black, as in the developed specimens. They lie along the breast, and reach to the end of the posterior femora, which is about the length of the whole body. The first two joints are retracted within a cavity in the front of the head, which seems to be the result of a doubling in of the front. Only the two posterior ocelli are visible, distant, and though enough of the front remains to contain the anterior ocellus, it seems as if it must be still farther forward than in the imago. The hind pair of legs is stuck straight out behind. (The abdomen is broken off.) The first and second pair of legs have the femur folded forwards; the tibia and tarsus lie towards the end of the body. This example lay within the skin of the larva, with its head towards the head of the larva.

A possible enemy is a greenish-yellow spider which draws down the edge of a coffee-leaf on the under side, and spins a light web from this edge to the surface of the leaf, leaving each end of the nest open.

Geographical Distribution. — As we have stated, M. Perrottet met these insects in the Antilles; M. Madinier found them in the island of Martinique; and I observed them in the Province of

Rio de Janeiro. They are said to extend over the whole coffee-region of Brazil.

History. — Dr. Christovão, and his brother Col. Antonio Corrêa e Castro told me that the coffee-trees were first introduced into Brazil by the Brazilian Minister at Paris, who sent two plants to the city of Rio de Janeiro, where they were planted on Mount Tijuca. From these two plants many others were obtained, which were kept in gardens as ornamental shrubs. Some of these were afterwards distributed to the plantations to be cultivated for commercial purposes. From them sprung the coffee-plantations of Brazil. Until about twenty years ago these plantations were free from all noticed pests. About that time, owing to the general exhaustion of the coffee-trees through long bearing, the Government imported quantities of new plants from the Antilles and from the isle of Bourbon, and distributed them all over the country. It was noticed during the very next year that the leaves of the coffee-tree were attacked by the larva of the moth, whose history is given here, which has ravaged the coffee-plantations of Brazil ever since. It cannot be doubted that the insects were brought from the Antilles with the plants, and that a proper examination of the plants at that time, by any person familiar with the appearance and habits of the enemies of the coffee-tree, would have prevented the introduction of so great a pest.*

Remedies. — The entomologist, like the physician, finds it much

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* *Bibliography.* 1. Guérin-Méneville et Perrottet. Mémoire sur un Insecte et un Champignon qui ravagent les Caféiers aux Antilles. Paris. Ministère de la Marine. 1842. 8vo. pg. 40. tab. 2. Gives the history of *Elachista coffeella.*

*2. Revue Zoologique. 1842. p. 126 - 127. Contains a notice of No. 1.

*3. Annales de la Société Entomologique de France. 1842. T. XI, Bulletin, p. II. Contains a notice of No. 1.

*4. Zeller. Linnæa Entomologica. 1848. T. III, p. 250, 272-273; T. II, tab. II, fig. 37-39. Establishes the genus *Cemiostoma.*

*5. Stainton. The Natural History of the Tineina. 1855. Vol. I, p. 284-334, tab. 1. Contains "General Observations on the genus *Cemiostoma,*" and the history of *C. spartifoliellum, laburnellum,* and *scitellum.*

*6. Nietner. Observations on the Enemies of the Coffee-tree in Ceylon. Ceylon. Published at the Ceylon Times Office. 1861. 8vo. pg. 31. On p. 24, mentions *Elachista coffeella.*

*7. Stainton. The Entomologist's Weekly Intelligencer for 1861. Vol. X, p. 110-111. "A few words respecting *Cemiostoma coffeella*; an insect injurious to the Coffee plantations of the West Indies."

8. Madinier. Revista Agricola do Imperial Instituto Fluminense de Agricultura. No. 8. p. 29 et seq. Brief notice of the Coffee-tree, containing on p. 33 an account of the habits of an insect called "*noctuella.*" which must be the *C. coffeellum.*

(The asterisks before the titles of the above works indicate that I have taken the titles and references directly from the works cited).

more difficult to choose a proper remedy for a disease with which he is familiar, than to trace out the nature and progress of the disease. But at this day the science of entomology, particularly in its practical application, is of such recent origin, that it suffers under a disadvantage from which the practice of medicine is free, namely, it possesses no treasury of results drawn from experience. The practical entomologist can only recommend measures to be put to the trial, and in this way gradually gather a body of experimental facts which may serve as a guide in the future.

The most obvious remedy which suggests itself is the collection and destruction of the leaves which contain the living larvæ. If this was done thoroughly, it would no doubt result in the complete extermination of the pests, a result the value of which would be incredible.

Towards this end Guérin recommends (Mém., etc., pp. 18-20) that "the branches of the coffee-trees which are loaded with [infested] leaves should be cut off in all parts of the country at one time, and burned, while the insect is in the larva state." If this were done, he says, "these coffee-trees should be cut down in such manner that the vegetation could resume its ordinary course shortly after the operation, to the end, if it were possible, of not having to regret but one crop of coffee. * * To attain this condition more promptly, the operation in question should be made with a cutting instrument, and at a height which should be determined by the proprietor himself (a metre and a half). Care should be taken to preserve here and there some young and vigorous branches, which would tend to maintain the equilibrium of the sap in all parts of the plant. * * Afterwards the development of new leaves ought to be watched with the greatest exactness, and if there should appear from place to place some spotted leaves, they should be destroyed promptly."

It will be seen that Guérin expects to cause the loss of one crop of coffee in his endeavor to exterminate the insect. Certainly the issue of the experiment, if successful, would be well worth the loss of an entire crop, but I think the same result could be obtained in a preferable way: entailing much more labor, but avoiding at the same time the loss. Probably not a single branch would be free from infested leaves, so that it would be necessary to find some other means of killing the larvæ in the leaves of those branches which remained. On the other hand, many healthy

leaves would be lost, if whole branches were cut off. I think it would be better to pick off all the infested leaves, and burn them, leaving the healthy leaves to support the tree. Guérin says [Mém. etc., p. 19] that "the epoch which it would seem ought to be the most favorable for this operation would be that which immediately follows the winter season, or that during which the temperature is the lowest, because the larva finds itself then as it were benumbed, and cannot be transformed into a moth until the return of a softer temperature." The time appointed for picking off the leaves might be, for the obvious purpose of saving labor, that at which the smallest number of old leaves remain upon the trees, if there is any such time. If the leaves were picked at such time as to take the greatest number of larvæ when they were about two weeks old, it would not be difficult to select them, as the size of the blotches would make them very noticeable.

I have made a theoretical estimate of the expense which would be incurred in picking off the leaves as I recommend, and of the relative increased yield of coffee which would result on a plantation of given size. Testing this theory by the numerical data given to me by Dr. Christovão Corrêa e Castro, and making large allowances for unfavorable circumstances, I find that the expense would be more than met by the next year's crop; but even if this should not be the case in the second year, it must be remembered that such a thorough and expensive war upon the insects never need be made more than once, and that with vigilance the trees could be kept in good order and the *increased yield maintained* continually afterwards. But vigilance must be exercised. One picking would not entirely exterminate the insects, however thoroughly it were done. The planters should also make experiments at all times, and seek other means of destroying not only this but all the enemies of their crops. They alone have the facilities for increasing and utilizing all the knowledge which can be gained upon these subjects.

Another remedy which Guérin recommends is "to kindle fires at all points of the coffee-plantations, at the time when the moths begin to issue from their cocoons. It is well known that many insects, and above all the nocturnal Lepidoptera, are attracted by light, and come whirling around a fire until they are burned there. Certainly a great number of individuals would be thus destroyed. At the same time, and to attain this object more promptly, lighted

torches might be carried through the plantations in the evening. Thus a crowd of moths, hidden in places to which the light of fixed fires could not penetrate, would be attracted, and killed." Although this measure would not be absolutely efficacious, unless practised for a long time and together over the whole country, which would be difficult to accomplish, yet it would repay all the labor expended upon it, if adopted at the time when the moths were abundant.

I will also recommend again the use of Col. Sorsby's process, which I have described at length in my report upon the enemies of Maize, drawing the description of it from the Report of the United States Commissioner of Patents for the year 1854, Part iii, p. 65.

I have thus stated all the direct means which have been suggested for the suppression of these pests. It is evident that none of them can be adopted without the expenditure of much time and labor. If other measures, less direct, could be employed, which would add to the efficiency, or take the place of those already suggested, the benefit would be great. Whatever measures are employed, however, must be founded upon certain general principles, in order to insure their success. What those principles are must first be learned, and then in what detail they can be applied. It is only in this way that we can determine whether there is any mode of opposing our insect enemies which will not cost more than it is worth.

Men gain time to advance in civilization and prosperity, by mastering the laws of nature, and converting natural forces into tools which do their work automatically as it were. Nature has provided enemies for the moth whose history we have been studying. Let us only learn how to cherish and encourage these natural friends of ours, and they will work for us thoroughly. They were made to work for us whenever we should learn how to command them.

I recommend that before the picked leaves are burned they be placed in an apartment from which the moths cannot escape, and there allowed to lie until the insects have developed. If such an apartment should be made with sides of glass, and a properly guarded entrance, it would be easy to capture the parasites while they rested on the glass, and to liberate them in the plantations, or transport them to other parts of the country where they might be needed more. At the same time the moths could be caught

MANN, ON THE WHITE COFFEE-LEAF MINER.

(Corrected.)

and killed. Or the sides of such an apartment could be made of gauze, fine enough not to allow the passage of the moths, but yet large enough to let the parasites out. Such a building could be placed in the midst of a plantation. I believe that eventually we shall have to rely mainly upon such indirect measures as a protection for our crops. It might even be worth while to undertake a positive cultivation of the parasites, at least at those times when the race has greatly diminished in numbers. It has often been observed, in studying the history of those insects which are subjected to unnatural conditions by man's cultivation of the ground, that there is an alternation of years or of series of years in which the insects are found to be very destructive, or to have almost entirely disappeared. These alternations are partly due to the influence of the seasons, but largely to the attacks of other insects. At first the destructive insects are found to be very numerous, but an examination will show that they have already been attacked by parasites which kill them, while the parasites themselves develop. This process goes on until the parasites have so far outnumbered their prey as nearly to exterminate them, when they will no longer be able to find food, and will themselves perish. Then once more the destructive insects will have an opportunity to multiply, and so the rotation will be continued. Now it is at the time when the destructive insects have been reduced to the smallest numbers that the enlightened agriculturist will find it most practicable to adopt such measures that their numbers may never again increase. Knowing how rapidly these insects increase, when not held in control by the forces of nature, he will feel that every effort of his to stop them at the first step will be an investment of labor at compound interest for a long time to come. Who then would count the trouble? But he must know what to do.

P. S.—I desire to correct an error in the former part of this biography, kindly pointed out to me by Mr. V. T. Chambers, of Covington, Kentucky, in the current volume of the AMERICAN NATURALIST, p. 489–490. On p. 338, I said that *C. coffeellum* was the only species of the genus known outside of the limits of Europe. This is a mistake. While I was in Brazil, Mr. Chambers described in the Canadian Entomologist, iii (1871), p. 23–25, a species from the United States, called *C. albella*.

As all but one of Mr. Chambers' references, in his note of correction, were wrong, I must, in order to be able to compare his species with the others of the genus, suppose it also due to negligence that he (through Mr. Stainton) describes the silvery gray metallic spot of the fore wings as apical, instead of at the inner angle. If this supposition is correct, *C. albellum* seems more nearly related to *C. coffeellum* than any of the other species, but may be known from it by having the spot at the inner angle of the fore wings silvery gray metallic, with very distinct black margins before and

behind, and an indistinct pale golden streak along the base of the fringe from the costa not quite to the inner angle; while it seems not to have the two oblique lines of black scales described in *C. coffeellum*, nor the golden band which partially surrounds the spot in that species.

Mr. Chambers says also, in his note of correction, that "in the Transactions of the London Entomological Society, Ser. 2, Vol. v, pp. 21 and 27, and in Ser. 3, Vol. ii, p. 101, certainly two, and if my [his] memory is not at fault, three species [of *Cemiostoma*], are described from India." I have examined the pages to which he evidently intends to refer, and find that both the species mentioned, *C. wailesellum* and *C. lotellum*, are said to come from England.

I have had a new edition of the accompanying plate struck off, because the former one contained some errors introduced by the artist, who transferred my figures from paper to wood. Some of the figures are incomplete, because I have only drawn what I could see. This is especially the case with the larva.

ON THE OCCURRENCE OF FACE URNS IN BRAZIL.

BY PROF. CHARLES FRED. HARTT.

On my visit last year to Brazil, my good friend, Senhor Ferreira Penna, showed me in the Museum of Pará a remarkably fine, well-preserved, and curiously-shaped burial vase of the class called by the Germans *gesichtsurnen*, or *face urns*, which had been obtained from a cave on the Rio Maracá, a little river in the Province of Pará, emptying into the Amazonas some fifty miles above Macapá. Of this urn, at his desire, I made the accompanying rough sketch with a few notes for publication in the NATURALIST.

The urn was intended to represent a human figure sitting on a low bench or stool. The body is cylindrical and, including the stool, is just about two feet in height.* Its diameter is about 9 inches. The legs spring from the body at a distance from its base equal to about one-fifth the height of the body. They are very short, small, cylindrical and hollow. They bend slightly to represent the knee, below which is a broad constriction intended for an ornament. Below this the leg swells to a ball as represented in the engraving. The feet are flat, irregular in shape, cut off squarely in front and furnished with six toes each. They are so constructed as to rest on the ground. The arms have their origin at a distance from the top of the body of the urn less than a

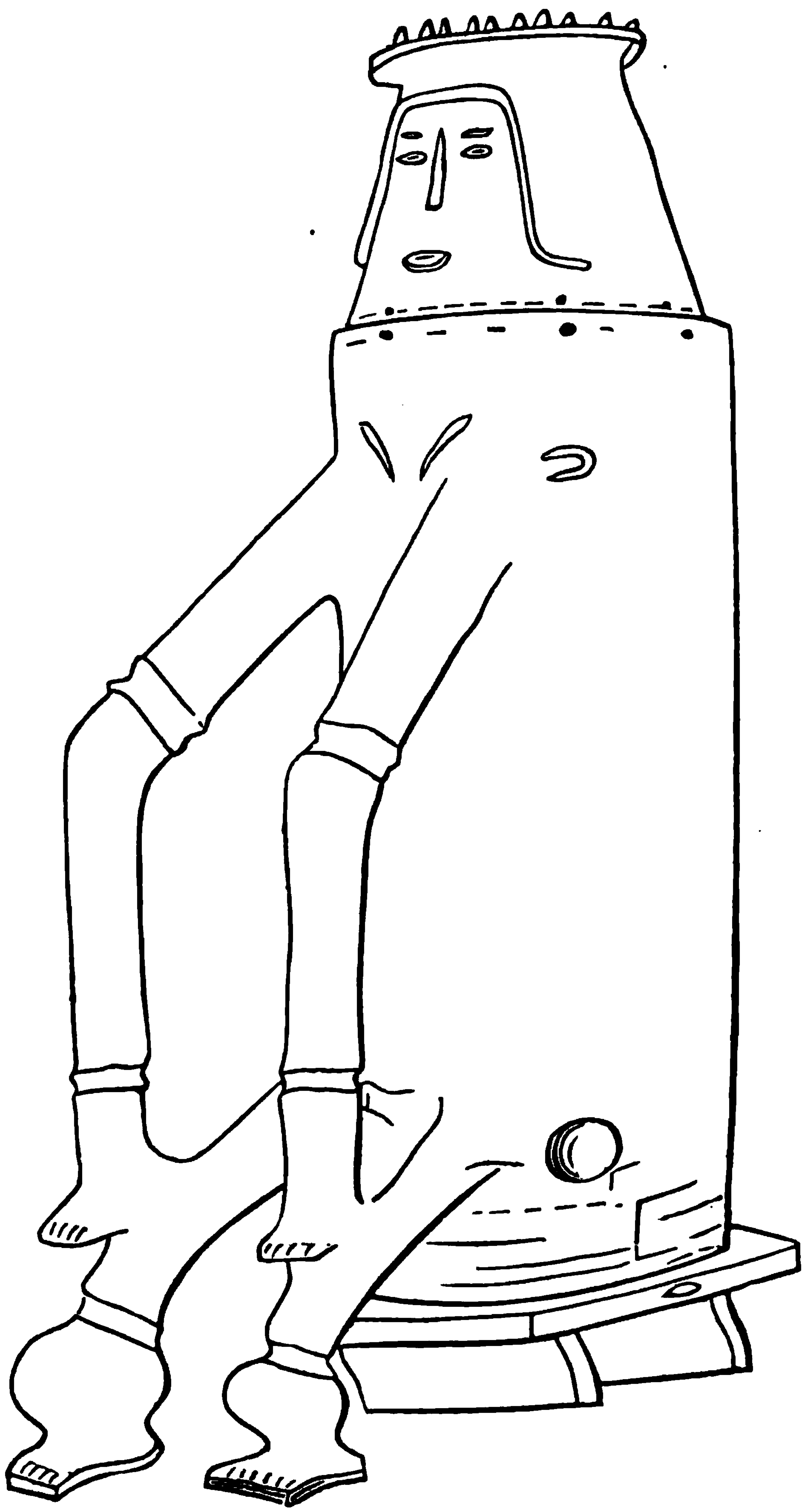
* The measurements given in this article are approximate, but were carefully estimated.

quarter of its height. They extend downward at an angle of 45°, more or less, and diverge a little. They bend abruptly downward at the elbow, the fore arm being perpendicular. The hands, resting on the knees, project forward like feet and are cut off squarely, the fingers, five in number, being indicated by scratches. This awkward turning forward of the elbows recalls the similar position of the arm of an Indian warrior, in the well known picture of the "Marriage of Pocahontas." The arms of the vase are cylindrical like the legs and not only longer but thicker than they. An armlet is represented just above the knee-like elbow, and a bracelet two or three inches above each wrist. Just above and between the shoulders are two short prominent ridges, shown in the engraving, which may be intended to represent clavicles. On each side, just back of the shoulder, is a similar ridge curved into a loop, the two ends of which are turned forward. On the back, coinciding nearly with the middle third of the mesial line is a thin finlike crest ornamented with lines drawn perpendicularly to the body. The figure is furnished with a carefully moulded, erect phallus. On the thigh is a low, cylindrical prominence, concave on the summit, shaped like the centrum of an ichthyosaur.

The head, answering as a cover, is in a separate piece, forming a hollow truncated cone 9–10 inches in height, the base being in outside measurement a little smaller than that of the upper part of the body of the urn. The top of the head is flat, with a projecting rim like a narrow brimmed hat and on the surface are a large number of sharp points, arranged in regular quincunx order. On the front of the cover is represented a face, the general arrangement of whose features is well shown in the sketch. The bounding line, eyes, eyebrows, nose and mouth are all in high relief and were applied after the head-like cover had been moulded. Around the base of the head-like cover are six holes to which other perforations in the rim of the base correspond. These were intended for strings used in tying on the cover, after which a brown wax was used to lute the two together. Of this material a portion still remains and bears the impress of what appears to be palm straw.

The base on which the figure sits is square, solid and supported by two upright, transverse pieces like sled runners; the whole resembling one of the curious stools hewn out of a solid block and used by the Amazonian Indian nowadays.

Fig. 131.



The material of which the urn is composed is a very coarse clay full of sand and consequently brittle when burned. The legs and arms are broken in several places. The surface of the vase is moderately smooth and the greater part is without ornamentation. The face has received a wash of ochre yellow clay. Near the base are a few white lines difficult to trace out, but which resemble the ornament on the burial vase, Fig. 65, in my little paper "On the Pottery of Marajó," in the NATURALIST for July of last year.

The urn, as it at present exists in the Museum of Pará, contains part of a human skeleton, showing no trace of burning. The cranium is wanting. It is impossible now to say whether the vase ever contained the whole skeleton. From the small size of the urn I should suppose, however, that it did not.

Senhor Penna visited, in February of this year, the locality where this curious urn was found and sent me a few notes on it. He says that several leagues up the Rio Maracá, at a short distance from the river, there is an immense flat mass of friable sandstone, in which is a large crevice, expanding, in one place, into a large grotto. Near by and on a plain, to reach which it is necessary to climb a steep hill covered by wood, is another small grotto lighted by a large opening above. On the floor of this last grotto, Senhor Penna found several urns, mostly broken, but of which two were entire. Some of these were of the same form as that I have just described, but others were shaped like armadillos and tortoises (*Jabuti*), though all had human countenances. Senhor Penna says that all the tubular vases, like the one just described, have the organs of sex, male or female, carefully and prominently represented.

Since the above was sent to press I have succeeded in restoring a magnificent female *gesichtsurnen* from the Ilha do Pacoval in Lake Arary, Marajó. In this urn the upper part is rounded so as to represent a head with human features. Besides this there occur in the collection made last winter, by my assistant, Mr. Derby, fragments of two other urns of the same class, one of which is furnished with *two* faces on opposite sides of the urn. These urns together with the new collections will shortly be described.

ON THE GEOLOGY OF THE ISLAND OF AQUIDNECK AND THE NEIGHBORING PARTS OF THE SHORES OF NARRAGANSET BAY.*

[Concluded from page 528.]

BY PROF. N. S. SHALER.

Glacial Deposits and Ice Marks.—The contour of a surface alone is generally sufficient to establish the former existence of glaciers, if they have ever worked upon it, but it is not to these indications alone that we must look for the evidence of the work of this great agent in this region. Every mass of rock exposed to view shows the rounded, smoothed and scored surface so characteristic of ice work. Every part of the island, level enough to carry such material, is buried beneath a coating of detrital material from two to forty feet in thickness. We propose to study these deposits of glaciated matter with a view to determine some of the more important features connected with the work done by moving ice.

These deposits have a composition which varies considerably according to the position in which they are found. At the extreme northern end of the island, all the pebbles found in them are from rocks which belong beyond its limits. The greater part of the pebbles can be referred to rocks which are in place on the shores of Mount Hope Bay to the northward, though some seem to come from points as far up as the neighborhood of Taunton. Only a small part cannot be readily referred to materials in place in the basins of the streams which flow into Narraganset Bay. It is of course impossible to assert that none of these unreferred specimens came from more remote regions to the northward, but inasmuch as there is a very wide difference noticeable between the glacial material in the basin of the Charles River and the other streams which flow into Massachusetts Bay, and this drift on the north of Aquidneck island, there can be little doubt that the transportation of erratics, from limits more than fifty miles away, has been very slight indeed, if it occurs at all. A large part of the drift mass is made up of boulders of a conglomerate, which

*This paper is taken from a report made to Prof. Benj. Pierce, Superintendent of the United States Coast Survey, and is published by his permission.

reminds one of the pudding stone in the neighborhood of Boston, but it differs from that rock in the comparative abundance of the matrix, and scarcity of pebbles of large size. The pebbles are, moreover, composed of different sorts of rock from those in the Boston conglomerates. After a careful inspection, I am compelled to conclude that none of the conglomerate masses are from that set of beds, which extend over the country to the north and east of the Blue Hills near Boston.

On the northern part of the island, a few of the syenite cliffs, which rise at steep angles from the plain, are the only points which have no drift matter upon them. Between these cliffs and the north slope of Butts Hill is a plain much indented by singular depressions already described (*vide supra* p. 523). The drift here has an unknown depth; it is known to be more than fifteen feet in thickness, and is probably at some points as much as forty feet thick. The pebbles here are with very rare exceptions less than six inches in diameter and are heaped together with only imperfect stratification. The cementing matter differs in no way from that which is always found in our boulder deposits, being a mixture of all the kinds of materials which go to make up the pebbly part of the deposit. There is no trace of true moraine heaps, such as fill the valleys in front of existing glaciers, in this part of the island. All the drift has, more or less, the character described by Agassiz, and by him referred to the melting of a great ice sheet, and the deposition, in a great unstratified mass, of all the pebbles which it had torn from its bed. Following the drift southwards, we find that without much change of volume the constituents become greatly altered in character. A large part of the materials which are found in it at the extreme northern end disappear, and are replaced by fragments from the rocks which belong in the immediate neighborhood. This is very clearly seen in the beds which overlie the portion of the island which contains coal. The matrix or cement of the mass is here much darker than in the drift near Blue Bill Cove; a large part of the fragments are of slate of a carbonaceous character. This blackish color extends to the drift found to the south of the coal field, though it becomes less and less marked as we go away from the source of supply of the coal. On the eastern shore we gradually leave the syenite boulders behind us as we go from north to south. Fragments of this sort of rock, which made up about one-half of the drift near

Anthony's, become rare when we get as far south as the glen, and are almost entirely wanting at Sachuest Neck. The conglomerate, with very much compressed pebbles, which does not occur north of the east and west line drawn from Black Point to Lawton's valley, is not found in the drift to the north of that line, though not infrequent in the beds of that age at all points to the southward of it. The north end of the island has a great quantity of conglomerate erratics but they belong to the type of that rock found to the north of Somerset on the Taunton River, and probably at other points in the direction whence came the glacial stream.

It will be shown further on that at various points the underlying rock of the island is traversed by veins of white quartz often having a thickness of many feet; the position of these veins, even when the rock in place is hidden, is often made evident by the trains of quartz blocks which lie mingled with the boulder mass, to the south of the outcrop of the vein. The actual thickness of the drift diminishes pretty steadily as we go southward; this is doubtless to be attributed to the soft character of the rock which underlies the island. That which the glacial stream rent from the bottom, in that part of its course which lies just north of the island, was of a much more resisting character than that which it encountered in its course over the island itself; naturally the endurance of the rock masses ground beneath the glacier was in proportion to the hardness of the material of which they were composed, so that where the rock was very soft the rapid disappearance of its fragments would prevent a great accumulation of débris.

Professor Agassiz has already called attention to the essential difference in the character of the débris of the wearing in the two modes in which glaciers may act. 1st, where the ice is in the form isolated streams bounded by distinct rock walls, as in the existing glaciers of Switzerland. 2d, where the ice is spread broadly over the surface of the continent, attaining to a depth which quite deprives it of all bounding walls, giving us a sea of glacial matter in place of the rivers of ice in the other condition. In the first condition of the ice, the rock boundaries of the streams furnish comparatively the larger part of the material transported by the glacier; something is torn away from the bed by the moving stream, but its comparatively thin mass gives it no such abrading

power as is possessed by the far thicker continental glacier. This last named form of the action can only take up masses of material from the base over which it grinds; its ability to rend fragments from the rock beneath it would always be far greater than the stream glacier, on account of its superior thickness and therefore far greater crushing power.

Examination of the materials deposited by these two forms of ice action shows us enough difference between them to enable us to determine to which of the two any given mass of glacial material belongs. Where a large part of the fragments are angular, showing no trace of grinding against the bottom of the glacier, we may assume that the ice which carried the material was a local stream which received the mass of its load from that part of the sides of the valley in which it flowed which were above the level of the ice; where on the contrary the whole of the débris is more or less rounded, a large part polished or scored, and all showing the effect of the abrasion which must occur when the fragments are dragged from their bed by the moving ice, we must conclude that the sheet had no side barriers from which a supply of débris could be furnished by falls and avalanches, as the existing glaciers in Switzerland are fed, but obtained their whole load from the bed rock.

I am well convinced that all the débris on the island of Aquidneck has been deposited by ice acting in the last of these two methods. Possibly there may have been a little action of a more local character, but the evidence forces us to the conclusion that the principal part of the drift found here has been deposited by the melting of a mass of ice in which it was held, rather than by ice streams heaping it up in the form of moraines. The probability that this was the method by which the glacial detritus was transported renders it the more likely that all the material is of local origin. Rock masses resting on the surface of a glacier are in a position favorable for transportation to the greatest distance that the stream can flow; not so the detritus which rests between the mass of ice and the bed rock. All the material torn up from its bed by the glaciers must remain permanently near to the same relative level in the ice mass, close to its base, for there is no possible means whereby they could become lifted into the upper parts of ice. Here they would be exposed to the wearing action which results from continual grinding against the bed of the stream or constant friction against each other; this must lead

to their speedy destruction. We thus see that by far the larger part of the eroded materials of the ancient continental glaciers must have been rapidly converted into mud which would have been easily swept away by the sub-glacial streams, which would have coursed beneath the great ice sheets of this region, just as they now flow beneath the Greenland glaciers and bear their tide of muddy water to the sea.

There are only two points where the glacial deposits seem capable of any other interpretation. Two-thirds of a mile north of the coal mines on the west side of the railway, there is a mass of drift having a form which strongly suggests that it might have been deposited as a terminal moraine. It is in the form of a ridge a few hundred feet long, and by its position, shape and structure is likely to have been the mass accumulated during the retreat of the ice stream when it paused for awhile with its termination at that point. The other point is at Portsmouth Grove, a few hundred feet to the south and east of the railroad station, where the drift is piled in a number of conical hills which lie in a general north and south direction. The internal structure is not shown by sections as at the other point, but there can be no reasonable doubt that the whole mass is of drift material. It is pretty clear that these hills have been formed in a different way from the rest of the drift; there seems no other reasonable explanation than to suppose that they were also formed by a retreating ice stream.

The evidence concerning the history of the glacial period, given by the remains it has left behind, is essentially the same as that which we find over the region to the northward. A period during which the ice sheet wrapped the land and extended far out to sea was succeeded by a time of rapid shrinking of the ice, rapid in a geological sense, though its complete passing away may have required several thousand years. During this period of retreat, the various channels of Narraganset Bay may have had more or less well defined glaciers, and these, though they would have gathered little débris upon their surface owing to the low nature of their bounding walls, would still heap up mounds at their terminations, at those points where their retreat may have been from time to time interrupted.

The actual amount of erosion during the last glacial period is not readily determined; there is some interesting evidence, however, to be gained from a study of certain instances of wear found

on Aquidneck Island. Wherever there is a mass of rock which juts abruptly from the general surface, it shows some of the peculiar marks of southward moving ice; besides the universal smoothing and scoring of the surface, each of these projections shows us the phenomena of "shock and lee sides," and the northern end is always more worn than the southern end. All the precipitous slopes of any considerable area are upon the faces away from the northern side of the masses to which they belong. This sort of evidence is visible in most regions which have been subjected to glacial action, but at two points on this island it takes a shape which has not been observed at other points on our coast. In the felsite district south of Newport Harbor there are many admirable specimens of rounded bosses of rock, the "roches moutonée" of the French geologists. These, one and all, show on careful study more or less of the shock and lee sides. There is one of these felsite masses which has its northern end riven into massive fragments which have been pushed around towards the south in such a fashion as to make the direction of the force very evident. We see here the prodigious rending force of the glacier, for there has been separated at one moment a mass of rock sufficient to furnish at least one hundred tons of boulders to the ice current.

The mass of conglomerate and associated materials known as Paradise Rocks also shows some interesting phenomena. These rocks consist of a set of ridges of steeply inclined beds of varying hardness, which owe their position to a number of parallel faults extending in a north and south direction with a considerable *throw*, so that the projecting edges of the rocks rise at sharp angles to the height of from fifty to one hundred and fifty feet above the sea level. Carefully tracing these rocks in the direction in which they are continued to the northward, it becomes evident that, at the time when they were formed, the ridges continued for several hundred feet to the northward of the base of the slopes which lead down to the comparatively low land which now bounds them on that side. We cannot resist the conviction that the powerful agent which has cut away these solid masses of rock was the ice stream which has so clearly scored their surfaces and left the marks of its power on every square foot of their remaining surfaces.

Very little of the surface of the island remains in precisely the condition in which it was at the time of the coming of the white

men; there can be no doubt, however, that it was quite uniformly covered with boulders of varied size. The thousand miles or thereabouts of stone walls which are found upon the island attest the original abundance of these surface boulders. Most of the larger masses have been broken up in order to be used for building purposes, but there still exist several thousand erratics having a diameter of more than three feet which have been deported from the cultivated fields, or lie in the regions which are too barren for cultivation. If we examine the sections in the drift, visible at various points, and notice the comparative variety of large boulders, it seems no easy matter to account for these numerous surface erratics without resorting to some such agency as floating ice operating at the close of the principal glacial period. This method of explaining the abundance of surface erratics is much in favor with many European geologists. There are many arguments against it, however, which make it in the highest degree unlikely that it was the main agent. On the highest hills these boulders abound the most; now there is every reason to believe that there has been at the most not over forty feet of subsidence on this shore since the beginning of the glacial period; a depression so considerable as to have lowered the level of the highest hills of Aquidneck island beneath the level of the sea, must have left some recognizable evidence of its existence. There is, however, no evidence sufficient of such a change of level. We can more satisfactorily account for the facts by assuming that these boulders of large size owe their abundance to the following causes. The rock masses in the glacier which were furthest from the rock bed would receive the least attrition and therefore remain the largest in size; moreover, the continual wear to which the upper part of the drift bed has been subjected has served to wash away a large quantity of the mud, which forms a great part of the mass, leaving the pebbles of various sizes accumulated on the surface. These great boulders should, on account of their superior position, have been riven from their parent rock at a greater distance from their present position than the other which lies below them. It is a tolerably safe conclusion that the lowermost pebbles in the mass which were riven by the ice from the bed rock, would be the last additions to the accumulation. Each successive accumulation would lift the débris which was already in existence, so that while in the time immediately after its separation from its bed the

fragment of rock would be subjected to great wear, it might, by the subposition of fragments more recently sundered, be gradually lifted out of the level of greatest attrition into a level where it would be carried without much wear. When the rock over which the ice flowed yielded fragments more rapidly than they were ground up, the conditions would be the most favorable for distant transportation; when, on the other hand, if the grinding of the pebbles went on more rapidly than they were supplied, the chance of distant transportation would be small. This is well illustrated over the southern part of Aquidneck island. When the glacier swept over the friable slates, the drift drawn from the northern end of the island kept in security in the upper part of the débris; when it passed on to the southern part of the section where the hard felsites and argillites were encountered, the packing of soft shale was quickly ground up, and then the syenite pebbles were let down upon the bed rock and soon reduced to fine material. The result is that the region known as the neck, south of Newport, has a very thin coating of drift matter.

All the boulders, of whatever size they may be and at all positions in the débris, show evidences of abrasion which cannot be explained without supposing that they were derived from the floor of the ice mass, and passed through the inevitable jostling which must occur while they were at the bottom of the pack.

There can be no question but that the retreat of the ice across the section given in this island must have been, in a geological sense, very rapid. The evidence is clear that at one time it extended far to the seaward of the southern end of the island, so far indeed, that we can find no distinct evidence at this point of the great masses of débris, which must have been deposited at the outer border in the shape of a great terminal moraine. As the ice went back, if its retreat had been by successive steps, any of which brought the edge of the ice across this island, the result would have been the formation of a distinct terminal moraine. It cannot be said that such a mark would have been obliterated by subsequent changes, for the scratches which cover the uppermost pebbles of the drift would surely have been worn away by any erosion which could have had great effect on the contour of the surface. We are therefore justified in supposing that the glacial sheet retreated rapidly and steadily, when it passed from the surface of this part of our shore. It does not seem as if the term retreat

could be used with propriety for the simultaneous melting, which appears to have taken place in the whole section here. I am inclined to think that the ice stream, no longer fed with glacial matter and probably wasted by great rains and a strong heat, gradually came to rest, and then the same process of decay slowly separated the water from the stones, dropping them into their present resting places.

The evidence of a readvance of the glacial matter, not in the form of a great sheet, but in the shape of separate streams, is by no means so clear here as it is to the northward. If it came at all it only lasted for a short time, and produced no considerable effects.

I am inclined to think, however, that both the east and west channels gave passage to ice streams which returned to them long after the main sheet had disappeared. These local glaciers did not, however, reach farther south than the middle of the islands.

The scorings upon the surface of the rock tell the same thing in all parts of the island; the general course is from the north by west towards the south by east, but the individual differences are considerable. Many scratches depart widely from this range. In the rude jostle which took place at the point of contact of ice and rock, there would necessarily arise just such changes of direction as are indicated on the rock surfaces. There is also a certain accommodation of direction of slope to contour of surface before a stout boss of rock, where the flexible stream would turn a little for an easier escape.

The cutting of the scratches is not as deep as in more northern regions; there is nothing like the long deep drawn grooves of northern Vermont, or the region about the Great Lakes. This may be due as much to the prevailing weakness of the cutting tools, the pebbles, as to a difference in the energy of movement of their setting, the ice. On Price's neck, a singularly good specimen of glacial erosion, the scratches are quite distinct and the amount of surface which shows ice action unusually large. The point of greatest interest connected with this locality is found in the evidence it affords concerning the depression of this region since the time when these furrows were graven. If it had been for any considerable time beneath the sea it would have surely been changed from its present character. I believe that most, if not all of it, was beneath the sea at the time when the glacial sheet

passed away, but the reëlevation was so quick that even these faintly traced lines were not worn away. Equally strong is the evidence they give concerning the nearness of the time when they were made. Although the rock is not the most enduring, having a considerable tendency to shatter, they stand almost as fresh as the carvings on Egyptian stones.

In attempting to measure the influence of the glacial action upon this region the first question which arises is whether we are to refer the whole of the erosion which is clearly to be attributed to this agent to the action of the ice time which immediately preceded the present geological period, or must look upon it as having been in part the work of more ancient glacial periods. Besides the general argument that there is a great improbability in the supposition that there has been but one glacial period in the earth's history, we have other reasons for believing that glacial action has been a constantly recurring element in the successive geological stages. The hypothesis of Mr Croll, which up to the present time is the most satisfactory theory that has been presented to account for the coming of the ice time, makes the change depend entirely upon the alteration in the eccentricity of the earth's orbit, and the change in the place in that orbit when the northern and southern hemispheres get their winter and summer exposures to the sun. Whether these hypotheses prove well founded or not there can be no doubt that the past geological record shows us evidences enough of glacial action. Every great conglomerate is in itself such evidence ; nothing but a glacial period is competent to produce or transport, into their present position, such masses of pebbles as make up the conglomerate which is found in the carboniferous rocks of this island. At almost every stage in the earth's history we have the same sort of accumulations. They abound in the primordial, are frequent in the palæozoic and mesozoic, and numerous in the tertiary. The Roxbury conglomerate found in the town of that name, and over a large part of the south and west shores of Massachusetts Bay, is so much like the modern drift, that at one point, where it is rather more incoherent than usual, the eye does not at first readily detect the difference between the glacial beds of the geological yesterday and the underlying conglomerate of the primordial time, so close is the physical connection of these beds which are separated by nearly the whole life-bearing section of the earth's crust.

The fact noticed in the paper on the Topography of Aquidneck Island (see Vol. vi, page 518), that the streams on this island have the arrangement natural to a local water system, shows that the channels which separate it from the main land had been excavated before the last glacial period. Now, as we have already seen, these channels have a shape which can only be accounted for by supposing that they were formed by the excavating power of ice. Therefore we are compelled to suppose that there was an ice action anterior to the glacial period which gave way to make our present time. If this be true of this section of our fiord zone, it is likely to be true for a large part of the topography of our shores which is dependent for its shape upon ice action. It would be imprudent to rest so large a determination upon such a small basis of observation; the question is, however, one which invites the consideration of all those who are interested in working out the history of our continent. Nor is the problem one of local interest alone; our whole conception of the conditions under which life has been developed and the successive sheets of strata laid down will be greatly modified by such a view of the past as would be forced upon us when we recognized glaciation as a constant factor in the evolution of the physical and vital history of our earth. We need some conceivable agent whereby the life of the past could have been subjected to ever varying conditions. If it has been driven in endless chase from equator to poles by the alternating changes of heat and cold, these variations would have succeeded each other with startling rapidity. This view is consonant with all we know of life in the past; it furthermore seems in the highest degree fitting that life, the product, the localization of solar energy, should find the spur that drove it onwards and upwards in the changes of its motive force.

ON THE CAUSE OF DETERIORATION IN SOME OF OUR NATIVE GRAPE-VINES, AND ONE OF THE PROBABLE REASONS WHY EUROPEAN VINES HAVE SO GENERALLY FAILED WITH US.

[Concluded from page 544.]

BY C. V. RILEY.

MEANS OF CONTAGION FROM ONE VINE TO ANOTHER.— The young lice, whether hatched upon the roots or in the galls, are quite active and crawl about for some time; and that they will spread from one vine to another, either under ground upon the roots or on the surface of the ground during the night, is highly probable. Such, however, cannot be the mode of spreading from one vineyard to another; for were it so, the malady could not possibly have assumed such proportions in so short a time as it has done abroad. One method of transport is upon the roots of seedlings and cuttings, but the insect cannot in this manner find its way to an old vineyard, and there must be still another means. Here we come to that part of the natural history of our louse which must assume the form of hypothesis until further observations shall be made. In this country the malady is general, but in France, where it is still spreading from one place to another, they have a good opportunity to watch its progress; and Planchon finds that it always commences at certain circumscribed points and spreads from these points in more or less regular circles. There is no way of accounting for these nuclei—these starting points in the centre of an old vineyard that never showed signs of the disease before, except on the hypothesis of the winged insect having flown there and started the colony.

We have already seen that certain individuals of the root-inhabiting type become winged. Why these individuals become winged while others never do, is, perhaps, not for us to understand. Signoret ventures the Lamarckian suggestion that the need of quitting roots that are already destroyed may be one reason, and the pupæ are certainly found more particularly on badly infested roots. All plant-lice multiply agamically during the summer months

while they are abundantly nourished, but towards winter when, by this mode of reproduction, and by the diminishing nutriment in the dying foliage, the lice become, so to speak, exhausted, then lo and behold winged males and females appear! Numerous other facts in insect life such as the production of drone bees solely from unfertilized eggs, etc., indicate that the winged male may be, in some way or other, connected with defective vitality; and Mr. Thomas Meehan, of the "Gardener's Monthly," has so frequently observed such to be the case with plants, that he considers it a law "that with a weakened vitality comes an increased power to bear male flowers."* But this throws no light on the production of winged females, and here, as in thousands of other instances, nature tells us plainly to be satisfied with the facts without the explanation.

Our winged female is a reality! What, then are her functions? In the breeding jars she invariably flies towards the greatest light, and her large compound eyes, and ample wings indicate that she was made for the light and the air. We have also seen that she is burdened with two or three eggs only, and my opinion is that after meeting her mate, her sole life duty is to fly off and consign her few eggs to some grape-vine or grape-bud, and that the lice hatching from these eggs constitute the first gall-producing mothers.

I am led to this opinion by the fact that about the middle of May, in looking for the galls, I always find but two or three to a vine, and generally but one to a leaf. These vernal galls, as one would expect from the greater vitality of the young from fertilized eggs, and the greater succulency of the leaves at that season are much larger than the ordinary summer form, and generally have a decided rosy tint on one side. Similar galls have also been found in France. Just as many other insects prefer certain species of plants, or even certain varieties of a species, so our winged *Phylloxera* shows her preference for the Clinton and its close allies. She occasionally deposits her eggs on other varieties, as I have found the large vernal galls on Concord, Hartford Prolific, etc., and it follows that she must do so where no *riparia* vines occur. But, except on the varieties of the latter species, the young lice hatching from her eggs do not seem to be capable of forming galls on the leaves, but make straightway for the roots.

*Proc. Am. Ass. Adv. Sci., 1869, p. 256.

Only in this manner can we account for the galls abounding so much more on some varieties than on others.

Some persons may wonder how a minute insect with such delicate wings, braced with so few simple veins, as those possessed by our *Phylloxera* can manage to fly through the air to any great distance; and those who have not witnessed them in flight are very apt to underrate their powers of volitation. There is a conical gall very common on the upper surface of the leaves of our Shell-bark hickories. This gall is made by a louse very closely allied to our Grape-leaf gall-louse and was named *Phylloxera caryæfoliæ* by Dr. Fitch.* This louse occurs abundantly in the winged form, and furnishes an excellent illustration of the power of the insects of this genus to fly. Let any one watch these winged gall-lice, as they issue, during some warm day in June, from the fimbriated mouth of their gall, and he will be struck with astonishment at the facility and power with which they fly off. They are no sooner out of the gall than the wings begin to vibrate so as to become invisible, and the insect suddenly darts away with wonderful force. They must likewise often be carried great distances by the wind.

Again, it would at first sight seem almost impossible for the female to deposit her loose eggs which have no viscous property, upon a swaying leaf, but this very feat is accomplished by another little louse of the same genus,† which may be found depositing its eggs all through the summer months, on the under side of the leaves of our young Post oaks.

PROBABLE REASON WHY ITS INJURIES ARE GREATER IN EUROPE THAN WITH US.—It is a well recognized fact among careful observers, that in the natural state there is a greater harmony between the fauna and flora of a country than in the more artificial state that civilized man induces by cultivation. Through a long series of ages, the species least able to contend in the struggle for life "go to the wall," until at last by a process of elimination, the balance is struck and we find the animal and plant world well adapted and adjusted to each other. For this reason the native

* Rep. III. § 166.

† This is a species of *Phylloxera*, which is yet undescribed but which M. J. Lichtenstein proposes to call *Ph. Rileyi*. It infests the leaves of our Post oak very much in the same manner as the European *Ph. quercus* infests their oaks—causing a similarly pale speckled appearance of the upper side of the leaves. It differs from all described species in the great length and prominence of the tubercles.

vines which now flourish in this country are those which have fought the long battle in the past and have best resisted the enemy. They are, in short, best adapted to the circumstances, and by their more vigorous nature resist the hypertrophy of the bark caused by the punctures of the lice, and form new bark under it. The European vines, on the contrary, are not only of a more highly improved and tender character, but have not been accustomed to the disease. They consequently succumb more readily, on the same principle that many diseases that are comparatively harmless among civilized nations, acquire greater virulency and play fearful havoc when introduced among savage or hitherto uncontaminated peoples.

There may be other reasons such as the different modes of culture and differences of soil; for in the French districts, so badly affected, the vines are either grown with a single stake or no stake at all, and their soil is generally much poorer than ours. In America, also, we know that there are several natural enemies of the louse, and these checks have, in all likelihood, never been imported into Europe with their prey. That the louse will in time find enemies and lose its acute power of doing harm even in Europe, is highly probable; and M. Planchon has already noticed that the infested vines in the latter invaded departments of Gard and Herault retained a comparatively greener color than in that of Vaucluse, first invaded. Such has been the history of the Hessian fly and a number of other insects imported into this country. These are the explanations I venture, and whether they be generally accepted or not, the facts remain.

Outward and more visible Effects of the Root Disease.—As long as the lice are confined to the more fibrous roots which, in a measure, are renewed each year, the vines show no decided outward signs of the malady, which may then be considered in its incipient stage. As they become multiplied and fasten on to the larger roots, their work becomes more visible in a sickly, yellowish appearance of the leaf; and a reduced growth of the vine is the result. As the roots waste away, these symptoms become more acute, and at this stage of the disease the lice have generally left, so that when the vine is about dying it is often difficult to find any trace of the cause of death. On the rotten roots little eight-legged mites are frequently met with, and they are

also to be found in the galls. They may always be distinguished from the true lice by their white, or dirty-white, color.

PRACTICAL SUGGESTIONS.—Last year, from the knowledge we then had of this insect in this country I recommended the destruction of the Clinton vine, where other and better varieties succeeded as well. This advice was given in order to get rid of the galls, and wherever it has been followed it has had the desired effect. It was given, however, under the impression that the lice would not attack the roots except where the leaves were covered with galls; whereas, in truth, the roots would appear to be less affected (at least during the growing season) where the leaf-galls are abundant than where they are scarce; while they may be absolutely ruined where no signs of galls exist. Consequently there is no longer any urgent need of, or good reasons for, destroying our Clinton vines. By doing so we may diminish the number of galls, but we can never exterminate the root-lice. Future experiments will no doubt show that good results will attend the grafting of such varieties as are known to be most seriously affected, on to the roots of less susceptible varieties.

The insect should be especially watched, as it is apt to be most troublesome, on poor, gravelly or clayey soils. In deep, rich soils I think there is less danger. In France it has been found to be less troublesome on sandy soils, and in my studies I have always noticed that minute, soft-bodied insects do poorly in sand.* The greater the growth of vine the greater the growth of root, and consequently vines that are trained on walls and which thus more nearly approach the wild state, or which are rendered vigorous by a rich soil, are least susceptible to the disease.

REMEDIES.—*Destruction of the Gall-Lice.*—From what we have seen, we may justly infer that this insect cannot of itself spread from one vineyard to another without going through the gall-producing phase: and a few galls on the leaves are, no doubt, invariably the first signs of its advent, by natural means, into a vineyard not previously attacked. By natural means, I mean without the aid of man's assistance, by which they are introduced from one place to another on the roots. If these galls, therefore,

* In examining the vine roots this fall in some parts of Northern Illinois, where sand formed a prominent portion of the soil, I found very few root-lice; except on *riparia* vines whose leaves had been covered with galls. Even on these the general healthfulness of the roots indicated that they had not been infested during the summer, and that the lice had all come from the last galls of the season.

could only be found and destroyed, it would be one way of effectually heading off the evil; and in a new vineyard a little vigilance in searching for these galls might save much subsequent loss and labor. I shall not treat here of the natural enemies of the louse, which are of such a nature that they cannot be practically controlled and increased.

Destruction of the Root-Lice.—I hope next spring to institute a series of experiments on the root-lice, with a view to the discovery of a practical remedy. It were to be desired that others having opportunity and occasion would do likewise. Here is an excellent chance for our different agricultural colleges, which have greater means and facilities than any one individual can possibly have. As a guide to such experiments, and to profit as much as possible by the experience of others, I will synopsize the results of trials in France. From these results, which I give below, we may learn that no reliable and cheap remedy, that will destroy all the lice after they have become numerous, has yet been discovered; and the best advice that can at present be given is to guard against the insect's introduction into new vineyards by carefully examining the roots before planting. If knots and lice are found upon them the latter may be destroyed by the same means used against the Apple root-lice—*i. e.*, by immersing the roots in hot soap-suds or tobacco-water.

Preparations of carbolic acid have, so far, given most satisfaction, and I have great hopes of benefit from the saponaceous compound prepared in this country by James Buchan & Co., of New York. This compound is not yet manufactured in France, where they have to use the pure acid or the crystals.

Carbolic acid added to water at the rate of one-half to one per cent. has been successfully employed, and M. Leenhardt, of Sorgues, has by its use, succeeded in keeping his vineyard alive and bearing, while all those around him are destroyed. He uses a heavy bar, thickened and pointed at the end, wherewith to make two or three holes, a foot or more deep, around the base of each vine. He then fills these holes with the liquid, which gradually permeates the soil in all directions. A good post-hole auger, such as we use in this country, would work more rapidly, with the advantage of compressing the earth less, but it would do more injury to the roots.

Oil of Cade.—This empyreumatical oil, which is common and

cheap in France, when dissolved in any alkali (the urine of cows being good enough) and applied in the same manner described above, has also given good results. A mixture composed of lime and sulphur boiled in water at the rate of about five pounds lime and five pounds sulphur to one gallon of water, and applied when hot, has been found good.

Alkalies seem to invigorate the vines, but do not affect the lice. They are also too costly. *Salt.*— Vines on lands strongly impregnated with salt have been found to resist the attacks of the lice. *Acids* generally are neutralized by the lime which most soils contain.

Sulphur has been thoroughly tried without any good results, either upon the leaf-lice or root-lice.

Sulphuretted hydrogen.— They have tried to pump this into the soil, but the pumps always break and no one would think of going to such trouble here.

Sulphate of Iron is of no account. *Sulphate of Copper* destroys the roots. Numerous other chemicals have been experimented with, but with very little or no success, and they are besides not applicable on a large scale.

Irrigation and *Submersion* have been pretty thoroughly tested, and it is doubtful, even where they can be employed, whether they have any other effect than that of invigorating the vines, as the lice are, many of them, found alive after a submergence of months. These methods must be considered conservatives rather than curatives.

RÉSUMÉ OF THE INSECT'S HISTORY.—We have had in this country, from time immemorial, an insect attacking our native vines, either forming galls on the leaves or gall-like excrescences on the roots.* This insect is polymorphic, as many others of its family are known to be. It also exists in two types, the one, which may be termed *radicicola*, living on the roots, while the other, which may be termed *gallæcola*, dwells in galls on the leaves. The latter is found more especially on the Clinton and its allies, while the former is found on all varieties, but flourishes best on vines belonging to the *vinifera* species. The gall-inhabiting type was noticed and imperfectly described in 1856, but the root-inhabiting

* I have been able to trace them with absolute certainty as far back as 1845, for in the herbarium of Dr. Engelmann is a specimen of wild *riparia* gathered in this State in that year, the leaves of which are disfigured by the very same gall.

type, being less conspicuous, was unknown in this country till last year.

Such an insect is very readily transported from one country to another on grape roots, seedlings, etc., and just as our Apple, root-louse (*Eriosoma lanigera* Hausm.) was imported into Europe towards the close of the last century, so we find that our Grape-louse was similarly imported, in all probability within the last decade. The mode of transport will become all the more intelligible when I state that M. Signoret showed me, last July, the yet living progeny of some lice which he had placed in a tightly-corked glass tube the year before; and that he had managed to keep a few alive for study through the siege of Paris up to the time mentioned.

Nothing would be more natural than its introduction at Bordeaux, where M. Laliman has, for a number of years, been assiduous in the cultivation and trial of our different American vines. Or it might have been introduced at the nurseries of the Audebert Bros., near Tarascon,* where all sorts of American plants have been cultivated; and, if I mistake not, M. Planchon with commendable zeal, has so thoroughly sifted the history of the subject in France that he can trace the first invasion, with tolerable certainty, to a point near this place, Tarascon. It doubtless existed in France a few years before its injuries attracted attention, and the first notice of its work was made in the vineyard of M. de Penarvan, at Ville-neuve-les-Avignon, in 1863. The scourge soon increased and spread, and in 1868 and 1869 acquired such dimensions as thoroughly to alarm the great grape-growing districts of beautiful France. At first all sorts of hypotheses were put forth as to its cause. Some book-worms even thought they had found in this root-louse the *Phtheir* of the ancient Greeks, but the intelligent labors of M. Planchon dispelled all such illusions, and and proved that the *Phtheir* of the ancients was a true bark-louse (*Dactylopius longispinus* Targ.) of a totally different nature and still existing in the Crimea.†

* M. Laliman, in the essay already mentioned (p. 63), shows that this nursery has not existed for nearly fifteen years; but this fact does not preclude the possibility of the louse having been first introduced there. It would only indicate, if the spread of the disease can be traced from that point, that it existed in France, without attracting attention, at an earlier epoch than is generally supposed.

† See an Essay entitled La Phthiriose on Pédiculaire de la Vigne chez les Anciens. Bulletin de la Soc. des Agr. de France, July, 1870.

In this manner our root-louse was known and studied in a foreign land before its presence was even suspected in this—its native country.

Conclusion—No Need of Unnecessary Alarm.—Knowledge of the facts I have here brought forth need not alarm the grape-grower any more than correct knowledge of some indisposition, hitherto incomprehensive and consequently uncured, should alarm the human patient. It was only a few years ago that our eyes were opened to the true character of the entozoon known as *Trichina spiralis*, and there can be little doubt but that previous to our knowledge of this parasite many a death occasioned by it was attributed to other unknown causes. It may not be more easy to cure the disease now than it was formerly, but we are, by understanding its nature, enabled easily to guard against and prevent it. "Full knowledge of the truth," says Helmholz, "always brings with it the cure for the damage which imperfect knowledge may occasion." The Phylloxera has always existed on our vines, and those varieties which in the past have best withstood its attacks will be very likely to do so in the future. The presence of a few lice on such varieties need cause no fear, for the idea of ever entirely exterminating such an insect from the country must be perfectly utopian, and all we can do is to watch and more particularly care for those varieties that most easily succumb. In the future, the vineyardist will be enabled, by the revelations here made, to trace to a definite cause many a failure which has hitherto been wrapped in conjecture and mystery.

In thus calling the attention of the grape growing community to this interesting little insect, which is sapping the roots of their vines, my intention is to do good and not cause unnecessary consternation. Let me hope that others may be induced to study the microscopic plague and thus not only assist to fill the gaps yet occurring in its natural history, but help us to become better masters of it. Only those who have witnessed the fearful havoc it has made abroad, where in three years it caused a loss of 25,000,000 francs in the single department of Vaucluse, France, can fully appreciate its importance and its power, under favorable circumstances, to do harm.

I must remind those who live outside of Missouri, that my observations in this country have been confined to different parts of this State and apply more especially to this portion of the

Mississippi Valley. The insect occurs, however, very generally over the country east of the Mississippi river, even into Canada; and there are strong indications that it produces similarly injurious effects elsewhere. To give a single example:—according to the records, most of the vineyards on Staten Island which were flourishing in 1861, and which were composed principally of Catawba, had failed in 1866, and Mr. G. E. Meissner, of Bushberg, who then owned a vineyard on that island, informs me that he had noticed the nodosities, and that the roots of the dying vines had wasted away.* I cannot conclude without publicly expressing my indebtedness to Messrs. Lichtenstein and Planchon, of Montpellier, France, for the cordial and generous manner in which they gave me every facility for studying the insect there, and witnessing experiments in the field.

REVIEWS AND BOOK NOTICES.

Recent Discoveries in Ornithotomy.—The authors' courtesy places two very notable papers on our table. I. Prof. Morse's embryological studies † have furnished one of the most important contributions ever offered in this country to our knowledge of the structure and development of birds. His entirely original researches, conducted with scrupulous care, in the most candid spirit, not only confirm the late determinations of Gegenbaur and other European anatomists, but take a long step beyond. We have from time to time been apprised of the author's progress in the investigation, and since its close have given the subject the closest scrutiny. In stating the points we believe that the author has established, we must also indicate those that we hold to be still questionable.

Prof. Morse finds four tarsal bones. Three of these have been very generally recognized of late, although rejected or at most not

* Since the above was written, I have listened to an essay on Grapes, by Mr. P. Manny, of Freeport, Stephenson county, Illinois. In this essay, which was read before the Illinois State Horticultural Society, the writer states that his Delaware, Iowa and Salem vines lose their lower roots. He attributes this loss of roots to the tenacity of the soil (though more likely owing to unseen root-lice) and has remedied it in a measure by grafting on Clinton roots.

† *On the Carpus and Tarsus of Birds*. By Edward S. Morse, Ph.D. Ann. Lyc. Nat. Hist., N.Y., X, 1872.

fully accepted, by such an eminent authority, for instance, as Owen, whom the author very properly arraigns for his unphilosophic handling of the carpal-tarsal homologies. They are two near bones, anchylosing together, and with the tibia, serving to form the characteristic avian bitrochlear malleoli; and one far bone which unites with the metatarsals. For these Prof. Morse accepts the determinations implied in Gegenbaur's nomenclature, calling them *tibiale*, *fibulare* and *centrale* (astragalus, calcaneum and naviculare). Many interesting details of the form, time and mode of fusion, etc., in different species are given. The fourth bone is a "new" one, the recognition of which as an integral element of the avian tarsus we owe to Prof. Morse. Authors have described a so-called "process of the astragalus" in certain birds, and it has been stated that the astragalus of higher vertebrates represents the tibiale and the intermedium (of reptiles), connate; but it remained for Prof. Morse to determine that a certain "pre-tibial" bone of a species of heron, noted in Prof. Wyman's manuscript, now published, as finally uniting the astragalus to form a "process" identical with that described by Huxley, is a distinct tarsal element which, for anything appearing to the contrary, must be identified with the reptilian *intermedium*. We consider this view entirely reasonable—in fact, we know of no other warrantable conclusion from our present data, and we are thus prepared to adopt all of Prof. Morse's views respecting the composition of the avian tarsus, without reserve or qualification.

If we must think that he has not been equally successful in determining the structure of the carpus, we are at least prepared to show cause for our lacking faith in some of his conclusions. Respecting this segment the author writes: "In the fore limb or wing there are at least four carpal bones, two in the proximal series, and two in the distal series. *When more than four carpals occur, as in the*" etc. The two of the near series are those that persist free in the adult carpus, well known as "scaphoid" (or "scapholunar") and "cuneiform," or, in better nomenclature, *radiale* and *ulnare*. The two far bones come of Prof. Morse's resolution of the so-called "epiphysis of the metacarpal into two carpal elements, one capping the mid-metacarpal, the other the annularis. Since the metacarpals of higher vertebrates, excepting that of the pollex, are well known to lack a proximal epiphysis, the part in question was early determined to belong to the carpus,

though it has been generally recognized as only a single bone. Prof. Morse's figures show plainly that there are always *two* ossific centres, and that the ossicles are often as distinct from each other as are the metacarpals they respectively cap. This important point may be considered as established. The author is uncertain of the homologies of these two far bones, querying whether that one capping the mid-metacarpal be intermedium and centrale connate, or *carpale iii* ("magnum"); but he provisionally holds it as *carpale iii*, and the other as *carpale iv*, as marked in all his figures.

The sentence we have italicized above will be met with surprise if not with suspicion, and we cannot believe, upon the data furnished, that more than four carpals occur. Indeed, the author himself explicitly records his uncertainty respecting the "extra" carpals mentioned as *apparently* present in Tyrannus and Dendrœca. The piece marked "*c*" in figure 47 (Tyrannus) is doubtless "the result of accidental pressure" which separated it from *carpale iii*, while that marked "2" in figure 48 (same bird) seems unquestionably pressed apart from *radiale;* in each case we would emphasize the author's words: "it is safe to reject its occurrence for the present." In the case of Dendrœca, we think that the difficulty of the supposed extra carpal can be satisfactorily explained. Prof. Morse has been led to believe that "the *ulnare* may unite with the ulna," because he several times observed a close mutual appression of the two bones, and failed to find an *ulnare* at all in two instances. But in figure 43, where no ulnare is represented, we are satisfied that the missing bone simply escaped the field of the microscope; while in figure 44, the bone marked "*i*" and supposed to be an additional carpal on the radial side is, in our judgment, the ulnare itself accidentally displaced to the right. In this last figure, it will be observed, the author queries the ulnare as having anchylosed with the ulna; but unless we are altogether misinformed, no such anchylosis ever occurs. In all birds, so far as we know, the ulnare persists free, and gives an insertion to the *flexor metacarpi ulnaris* (just as is incidentally shown in fig. 34). Accounting as above for the respective disagreements of figures 43, 44, 47 and 48 with the others, all the figures show clearly the four carpal bones that the author may justly claim to have established.

Respecting the carpal-tarsal homologies, of which the author

does not specially treat, we should say that, while the antitypy of *tibiale* and *ulnare* and of *fibulare* and *radiale* appears unquestionable, observations are wanted to show the relations of the remaining tarsal bones with those of the distal carpal series; for if Prof. Morse correctly identifies the latter as *carpale iii* and *iv*, these do not correspond with those of the tarsus determined as *intermedium* and *centrale*.

This remarkably able paper is illustrated with two colored plates containing forty-eight figures from the author's accomplished pencil, representing exactly what he saw. We trust that Prof. Morse will continue his admirable embryological studies, and show us more new things. Ornithology has plentiful need of workers of his stamp.

II. Although we only undertake to give a complete record of *American* papers relating to ornithology, we shall have frequent occasion to notice foreign publications of general interest or special importance. Prof. Reinhardt* makes an important announcement respecting "l'os crochu" (*os uncinatum*) observed by Magnus in Phœnicophæus, and which, he states, is the same as the *ossiculum lacrymo-palatinum* described by Brandt in Tachypetes and various *Procellariidæ*. He further states that this bone is highly characteristic of the *Musophagidæ*, having found it in all the genera and nearly half the species of Turacous. He describes its peculiarities in detail. Among the Cuculidæ, besides Phœnicophæus, he has seen it in Zanclostomus, Rhinortha and Eudynamys, whilst it is wanting in Centropus and several American forms. In the *Trogonidæ*, a species has the uncinate bone "represented by a slender falciform apophysis of the descending ramus of the lachrymal, bending towards the palate." Tachypetes remains the only totipalmate bird in which the ossicle is known to occur—which is interesting, seeing that the frigate alone of *Steganopodes* is petrel-like in superficial aspects. The bone appears to be as characteristic of the *Procellariidæ* as of the Turacous, occurring in nearly all of the genera of that family, though among the "stormy petrels" (Thalassidroma AUCT.) it is merely represented by a ligament; but what, if any, relationship it may indicate does not appear. Prof. Reinhardt agrees with Brandt that the function of the bone relates rather to the olfactory than to the visual apparatus.

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* *Om en hidtil ukjendt Knogle i Hovedskallen hos Turakoerne* (Musophagides), etc. Af J. REINHARDT. Vidensk. Meddel. f. d. Naturh. Foren. Kjöbenhavn. 1871.

The author takes the opportunity of correcting Huxley's hasty generalization respecting the absence of basipterygoids in *Procellariidæ* – an error which, however, had been already exposed.* Although these processes are absent in Diomedea and rudimentary in "Thalassidroma," they are well developed in other genera; and the fact is, that basipterygoids are highly characteristic of the *Procellariidæ*. — ELLIOTT COUES.

GUIDE TO THE STUDY OF INSECTS.†— A third and revised edition of this work has appeared with a few changes and additions of considerable importance. The author calls attention to the change in his views as to the number of segments in the head of six-footed insects; there being four instead of seven. A brief account of the recent discovery of Parthenogenesis in the pupa of a Chironomus is given; and also of wax-secreting glands lately found in wax-producing insects, *i. e.*, the bees, aphides and bark lice (*Coccidæ*). Moreover a correct figure of the caterpillar and chrysalis of *Melitæa Harrisii*, takes the place of the incorrect representation in the first two editions, while a short notice of the worm-like mites, *Linguatulina*, is inserted.

The Appendix consists of illustrated notices of the early stages of certain ichneumon parasites; of the embryonal membranes of insects; of the development of the louse: the mode of formation of the wings of insects; of Paolia, a remarkable fossil carboniferous insect and of abdominal sense organs of certain insects, while sketches of Schiödte's new classification of the Hemiptera, and Thorell's arrangement of the spiders are presented. Two plates are added, illustrating injurious and beneficial insects. Two other steel plates, one of lice, the other of Thysanura are added, and several new species of insects referred to.

THE DESMIDS.‡ Microscopists will welcome this beautiful memoir on the desmids of Sweden. It will be invaluable to American observers, as there is so much similarity between the

* By T. HALE STREETS. Proc. Phila. Acad., 1870, 85.

† Guide to the Study of Insects, and a Treatise on those injurious and beneficial to Crops: for the use of Colleges, Farm-Schools, and Agriculturists. By A. S. Packard, Jr., M.D. With 15 plates and 670 woodcuts. Third edition. Salem, 1872. 8vo. pp. 715. Price reduced to $5.00.

‡ De Desmidiaceis, quæ in Suecia inventæ sunt. Observationes criticæ. Auctore P. M. Lundell. Cum tabulis V, pp. 100. Nova Acta of the Royal Society of Sciences of Upsala, 4to, 1871.

desmid floras of the two countries. It is written entirely in Latin. Five excellent plates illustrate the paper.

BOTANY.

LEMNA POLYRRHIZA.— While botanizing last week on the Platte river in Nebraska, I found, near Fremont, large quantities of *Lemna polyrrhiza*, and upon close inspection to my great joy found many specimens in bloom. As this is rarely found in bloom, it may perhaps be deemed worthy of record. I secured specimens which I shall be glad to distribute. I may as well mention also that in the same trip I found *Euphorbia marquiata* in great abundance in western and northwestern Iowa, though Prof. Gray puts it as far west as the "plains of Kansas and Nebraska."—C. E. BESSEY, *Iowa State Agricultural Coll.*

NEW BOTANICAL WORKS.—A new part of Bentham and Hooker's "Genera Plantarum" is in the printer's hands, as we learn from Trimen's "Journal of Botany," and is expected to be out by the end of October. It will comprise Rubiacæ, Compositæ, and the intervening orders.

Mr. M. C. Cook's new journal "Grevillea," devoted to Cryptogamic Botany and its literature, contains much that will interest American botanists. The August number continues Mr. C. A. Peck's "New York Fungi," and announces that a series of papers on North American Fungi, by Rev. J. M. Berkeley will be begun in the September number.

We have received the first number of the "Transactions of the Imperial Botanic Garden at St. Petersburg," an octavo of 164 pages, printed partly in Russian and partly in Latin.

ZOOLOGY.

TORNARIA, THE YOUNG STAGE OF BALANOGLOSSUS.—The development of Tornaria has at last been solved. As is well known Müller, Krohn, Fitz Müller and myself have considered it a starfish embryo. The analogy between a Brachiolaria and Tornaria seems complete and no one questioned the position of the latter till Metznikoff in 1870 was fortunate enough to raise Tornaria to a later phase of development—to his astonishment it changed into an annelid. Of course, in view of the affinities (first sug-

gested by Huxley) of the worms and echinoderms, it was most important that Metznikoff's observations should be repeated, and if possible the genus of annelids, of which Tornaria was the young, accurately ascertained. The annelid raised by Metznikoff was most peculiar and, in absence of other evidence, he suggested the possibility of its being a young Balanoglossus. I have been able this summer to raise Tornaria and to obtain young annelids somewhat older than those observed by Metznikoff, tracing at the same time the development of the branchiæ as diverticula from the œsophagus, and also to find the young annelid of Tornaria a species of Balanoglossus (of which the adult is quite common at low water mark at Newport and at Beverly, Mass.), but slightly older than those raised directly from the Tornaria stage. The details of this interesting embryology will shortly be published. — A. AGASSIZ.

THE PECULIAR COLORATION OF FISHES, mentioned by your correspondent Richard Bliss, is, it appears to me, susceptible of easy explanation. The pigment-cells containing the brilliant crimson, adorning the skins of *cyprinidæ* and other fishes, are readily opened and closed under excitement and other influences. When brilliant *Cyprinid* are confined in aquaria they speedily lose their color by the closing of the cells, but it may be readily restored by scratching the surface with the point of an instrument, which reopens the cells. Even specimens freshly placed in weak alcohol may sometimes be made to display bright color by the same process. When the alcohol is strong, it may so contract the surrounding tissue as to expose the contents of the cells, as in the case observed by Mr. Bliss.—EDW. D. COPE.

A NEW SPECIES OF PASSERCULUS FROM EASTERN MASSACHUSETTS. In December, 1868, I took a sparrow at Ipswich which was then supposed to be *Centronyx Bairdii.* In the autumn of 1870, I took two more of the same species, also at Ipswich; but upon visiting the Smithsonian Institution this spring and comparing these specimens with the original *C. Bairdii*, I have come to the conclusion that they are specifically distinct. They are closely allied to the savanna sparrow and evidently belong to the same genus; I therefore propose to name the Massachusetts bird *Passerculus princeps*, the large barren ground sparrow. The *Centronyx Bairdii* should also, I think, be referred to the genus Passerculus, for I can

see no good generic character by which it can be separated. A description and figure of this new Passerculus, will be found in the "Naturalists' Guide" (page 112) under the name of *Centronyx Bairdii*, with a history of the capture of the first specimen and also an account of how this name came to be applied to it. It will likewise be understood that the name of *Centronyx Bairdii*, given in a notice in the May number of the NATURALIST (page 307) by Mr. Brewster, should read *Passerculus princeps*.

The *Thalasseus Havelii*, mentioned by Mr. Brewster in the same article, should also read *Sterna Forsterii*, for I have become convinced by carefully studying a large number of specimens that the *Thalasseus Havelii* = *Sterna Havelii* of authors, is the young of *Sterna Forsterii*. — C. J. MAYNARD.

GEOLOGY.

OIL CREEK PETROLEUM KNOWN IN THE LAST CENTURY.—At a meeting of the California Academy of Sciences, July 15th, Mr. R. E. C. Stearns presented a communication, embodying the following extract from the Massachusetts Magazine published in the year 1789, Vol. i, p. 416, showing that the existence of petroleum in Pennsylvania was known at that period:

"In the northern part of Pennsylvania, there is a creek called Oil Creek, which empties into the Alleghany river, It issues from a spring, on the top of which floats an oil similar to that called Barbadoes tar; and from which one man may gather several gallons in a day. The troops sent to guard the western posts, halted at this spring, collected some of the oil and bathed their joints with it. This gave them great relief for the rheumatism with which they were afflicted. The water of which the troops drank freely operated as a gentle purge."

MICROSCOPY.

SUCCESSIVE POLARIZATION OF LIGHT.—This curious scientific procedure has been accomplished in connection with the ordinary polarizing microscope, by Mr. J. W. Stephenson. In the selenite fitting of the polarizer, between the polarizing prism and the stage, he places, mounted so as to have a rotating movement of its own, a truncated glass prism having its broadest face silvered by the sugar of milk process, and its other faces so situated that light, polarized by passing through the Nicol's prism in a direction

parallel to the silvered surface, is refracted on entering the prism, meets the silvered surface at an angle of 72° and is, after reflection, refracted on leaving the prism into a course parallel to that at which it entered. Some of the curious effects produced are mentioned in the Transactions of the Royal Microscopical Society.

A Double Erecting Binocular.—In the Report of the Croydon Microscopical Club, it is stated that at its last annual meeting there was exhibited an erecting binocular on Mr. Stephenson's plan, made double so that two persons could examine the object at the same time.

Angular Aperture of the Eye.—It having been carelessly assumed that in order to obtain a perfectly natural effect, the lenses of a photographic camera must be reduced to a linear aperture $\frac{2}{10}$ in., the average diameter of the pupil of the human eye, and that a large aperture gives objects differently from ordinary vision, Mr. G. S. Cundell observes, in the "Monthly Microscopical Journal," that the ocular focus is only about $\frac{8}{10}$ in., and therefore only four times its linear aperture. A corresponding size of camera lens having 12 inch focus would be 3 inches, not $\frac{2}{10}$ inch. Such a lens, so far as aperture is concerned, would be as free from aberrations and "distortion" as the human eye. For the sake of stereoscopic effect he would use a lens of $2\frac{1}{2}$ inches diameter, that corresponding with the average distance apart of the human eyes, and reproducing the object, a head for instance, as we see it in nature, without the hard, cutting lines of monocular vision, which all painters deprecate and avoid.

NOTES.

We take pleasure in calling the attention of our readers to the publication, in another portion of this number, of the several memorials made to the Commissioners of the Central Park in New York, relative to Dr. Hawkins, and the restoration of his work so wantonly destroyed by order of Mr. Hilton, who, we understand, is no longer in charge of the works of art and nature which he evidently did not have the education fully to appreciate. As these memorials are the expression of the most cultivated and influential class of citizens of New York, and can but meet with a warm response throughout the country, we trust that the present Board of Commissioners will fully realize the importance of restoring

Dr. Hawkins' work and of allowing him to extend the very instructive series which he had planned. Not only does it devolve on the Commissioners to render justice to Dr. Hawkins, but also, by the restoration of the work and the reinstatement of Dr. Hawkins, to remove a blot from the fair fame of American science.

It seems as if the interference with the work of scientific men and their snubbing by the "Heads of Departments" had been epidemic of late, for not only have we to regret the treatment of Dr. Hawkins and Dr. Parry in this country, but also the equally outrageous treatment of Dr. Hooker by the Head Commissioner of the Kew Gardens in England, as lately made public in "Nature." Are we really going back to the early days of science, when a scientific man was looked upon as a subject for the mad house, or is it owing to the fact that "brains are scarce in high places?"

We take this occasion to correct an impression which we find is held by some of our readers relative to the American Museum of Natural History, which is supposed by many persons not acquainted with the complex system of the Central Park, to be under the same government as that which Mr. Hilton represented, and that its officers were in a measure responsible for the outrage perpetrated. Such is not the case, and we should feel great regret if any remarks of ours had been construed to the disadvantage of that institution, which we believe to be doing good work and worthy of all assistance from scientists throughout the country.

[Wishing to give the address by Prof. Gray in this number we have been obliged to postpone a large amount of Miscellaneous matter which was in type.—EDS.]

ANSWERS TO CORRESPONDENTS.

C. B. G., New York.—The spider is *Epeira spinea* of Hentz.

BOOKS RECEIVED.

Preliminary Description of new Tertiary Mammals. Part III. By Prof. O. C. Marsh. Published Aug. 13, 1872. (Received, Aug. 14, 1872.) 8vo. pp. 9. From the American Journal Sciences and Arts. Sept. 1872.

Note on Tinoceras anceps. By O. C. Marsh. Published, August 24, 1872. (Received Aug. 26th,) From Amer. Jour. Sci. Arts, Oct. 1872.

Proceedings Academy Natural Sciences, Philadelphia. 8vo. pp. 73–88. July 16, 1872. pp. 105–120. (Received July 25th.)

Transactions of the Imperial Botanic Garden of St. Petersburg. Vol. 1, No. 1. 8vo.

Grevillea, a monthly Record of Cryptogamic Botany. August, Vol. 1. No. 2. London. Edited by M. C. Cooke. 8vo. pp. 16.

Notice of some New Tertiary and Post-Tertiary Birds. By Prof. O. C. Marsh. Published Aug. 30, 1872. (Received Aug. 31.) From the Amer. Jour. Sc. Arts. Oct. 1872. 8vo. pp. 8.

Preliminary Description of New Tertiary Reptiles. By Prof. O. C. Marsh. Part I. Published Sept. 6, 1872. (Received Sept. 9, 1872.) From Amer. Jour. Sci. Arts. Oct. 1872. 8vo. pp. 7.

Preliminary Descriptions of New Tertiary Mammals. Part IV. Published August 17th, 1872. From the American Journal of Science. Sept. 1872.

Die Grundlagen des Vogelschutz gesetzes. Von G. R. v. Franenfeld. Wien. 1871. 8vo. pp. 12.

Die Wirbelfauna Niederosterreichs. Von G. R. v. Frauenfeld. Wien. 1871. 8vo. pp. 16.

Der Vogelschutz. Von G. R. v. Frauenfeld. Wien. 1871. 8vo. pp. 48.

it, or a horse killed at a single blow. It is described as a "two-handed staff, about three feet and a half long, in which at regular distances, were inserted transversely, sharp blades of *itzli* (obsidian)." Some accidental discovery of this kind may sometime indicate to us the use of these strange "plummet" implements, wrought with so much care, and bearing such a striking similarity to each other, whether found in the débris of the mountains of California, the mounds of Ohio, or on the banks of the Mississippi. In the meantime we can only speculate upon the uses made of them, and in this paper I propose to enumerate, describe and figure some of them, show the circumstances under which they were found and offer some conjectures upon their uses.

Fig. 132 represents what may be styled the typical form of these implements. It is made of iron ore, ground down and polished, until it is almost as smooth as glass. It is one of eight found by Henry Root, Esq., of Quincy, Illinois. "They were found two miles north of Quincy, at the foot of the Mississippi Bluff, about two feet from the surface, embedded in solid clay. Two were found in digging one post hole, and six others within a few feet." The one figured * above is in my possession, another one of the same number very much like it, is deposited in the State Geological collection at Springfield, Illinois. Prof. Worthen informs me that the iron ore, out of which they were manufactured, was obtained from Iron Mountain in Missouri.

A fragment of one found in Scott County, Illinois, upon the surface of the earth was also made of iron ore. The broken ends are very much worn, as if ground down by hand or by time.

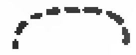
Another one (Fig. 133), having the general shape of figure 132, except that it is much wider in the widest part, was also found on the surface of the earth near the Illinois River in Scott County. The dotted lines are the restoration of the small end, which was broken off. This was found in a field on top of the bluff by Mr. Gardner. Within a mile of where it was picked up is the site of an old Indian village, where pottery, arrow heads, axes, etc., are found. In the burying ground, upon a hill near by, I found traces of funeral ceremonies which were not practised by the Indians of this locality, when discovered by the French in the latter part of the seventeenth century. Upon opening a mound about ten feet in diameter and three feet in height, I found as many as eight

* All the cuts here given are of the exact size of the implements.

skeletons, all showing distinctly the marks of fire. They were thrown together without any regularity whatever. There were no ashes nor cinders in the mound, which led me to believe that the bodies had been burned near by and the charred remains thrown upon the tomb of the person whose remains were found below them. The bones of this single individual were found at the base of the mound. He (or rather she, for from the skull I judge that it was a female) was buried originally in a sitting

Fig. 132.

Fig. 133.



Iron Ore (natural size).

Gray Crinoidal Limestone (nat. size).

posture, but the weight of the superincumbent earth had forced or crowded the vertebræ of the neck into the bifurcation of the lower jaw, and had twisted the head down to one side, so that when found the skull was resting on its side with the face to the east. A skull remarkably flattened by artificial means, or distorted, was found, similar to that of the Peruvian Child, plate No. 10, of Dr. Morton's "Crania Americana." We here see evidence of two practices, that of sacrificing the living upon the

grave of the dead, and the distortion of the skull, both of which were common among the Natchez and other tribes upon the lower Mississippi, but neither of which was practised by tribes living upon the banks of the Upper Mississippi, since its discovery. Whether the "plummet" found near their village belonged to them, or to some older population, can only be a matter of conjecture. The implement is made of a whitish limestone containing numerous small joints of Crinoids.

A much smaller implement, but evidently used for the same purpose (Fig. 134), was found *sixteen feet* below the surface of the

Fig. 134. Fig. 135. Fig. 136.

Green-stone (nat. size). Stone (nat. size). Copper and Silver (nat. size).

earth, in Brown County, Illinois. It is made of green stone. With it were found a small stone scraper and a small disk. The locality where it was found was the bed of a ravine which had been filled up by soil washed from higher ground.

The one represented in figure 135 is copied from Schoolcraft's work, Vol. IV, 175. He describes it as "a fisherman's sinker, of the Penacook tribe, accurately wrought in stone."

In a mound at Marietta, Ohio, "near the feet of a skeleton was found a piece of copper (Fig. 136) weighing three ounces (now in

the Museum of the Antiquarian Society of Worcester). From its shape it appears to have been used as a plumb or for an ornament, as near one of the ends is a circular crease or groove for tying a thread; it is round, two inches and a half in length, one inch in diameter at the centre, and half an inch at each end. It is composed of small pieces of native copper pounded together; and in the cracks between the pieces, are stuck several pieces of silver, one nearly the size of a half dime. A piece of ochre or paint, and a piece of iron ore (hematite) which had the appearance of having been partially vitrified (*polished*) were found." "The body of the person here buried was laid upon the surface of the ground, with his face upwards, and his feet pointing to the southwest. From the appearance of several pieces of charcoal and bits of partially burned fossil coal, and the black color of the earth, it would seem that the funeral obsequies had been celebrated by fire; and while the ashes were yet hot and smoking, a circle of flat stones had been laid around and over the body. * * *

"The mound had every appearance of being as old as any in the neighborhood and was, at the first settlement of Marietta, covered with large trees. It seems to have been made for this single personage, as the remains of one skeleton only were discovered. The bones were much decayed, and many of them crumbled to dust on exposure to the air."*

About ten years ago one of these implements was found, under remarkable circumstances, in Woodbridge County, California. From a paper read by Dr. J. W. Foster before the American Association for the Advancement of Science, at Chicago, 1868, I extract the following description. "The workmen after digging *thirty feet below the surface* struck a plummet composed of *sienite*, ground smooth and formed into a double cone, showing that it was suspended by a string and used to determine perpendicular lines. It affords an example of the lapidary's skill superior to anything furnished by the stone age in either continent." The well was sunk by Jeremiah Wood, on the premises of Mr. McNeely. But if the depth in the earth, at which this specimen was found, is calculated to impress us with the great antiquity of these implements, what shall we say of those found in Table Mountain, in the same state? In a paper read by Professor W. P. Blake, before the same meeting of the Association held at Chicago, 1868, we

* Aboriginal Monuments of New York, by E. G. Squier.

find the following description of the mountain and the relics of art found in it, among which were "some instruments resembling plummets." Where the mountain now stands was a valley traversed by a river. Here ages since, there commenced a deposit with gold, pebbles, mud and sand. Volcanic action encrusted these with ashes, and at last all was covered by the lava. As the valley filled up, the water of the river cut on each side of the accumulating mass a channel commencing at the base of the deposit of lava. In time it washed its way until the Table Mountain stands erect and two valleys are formed, one on either side of it. This mountain extends with its flat summit for miles, its surface edge being a bold bluff of black appearing rock, with little or no vegetation upon its plane. The thickness of the entire deposit averages from one to two hundred feet, the height of the lava above the newly formed valleys being from one thousand to fifteen hundred feet. The miner seeking the auriferous deposit, having, by sinking a shaft, ascertained the greatest depth of the whole deposit, tunnels from the side of the valley, and this process has brought to light teeth of extinct mammalia as well as relics of human art. Among these were two stone objects which were supposed to be shovels used in cooking, by placing them upon or into the burning fuel; a mortar or dish, *some instruments resembling plummets*, and several spear heads."*

In all the specimens thus far described, no effort whatever was made by the artist to modify the form of the implement for the sake of either ornament or novelty, except the Marietta specimen, which had silver worked in the crevices. Whether of stone, copper or iron ore, it consists simply of a double cone, with the bulge nearer the base than top, and a very slight groove around the small end, for the purpose of tying the string by which it was suspended. Not even a line or mark is found upon their smooth polished surfaces, but the following relic (Figs. 137 and 138) is an exception to the above rule. The profile is neatly cut as if the artist had worked with a sharp cutting instrument. The vertical occiput, retreating forehead and massive jaws, give to it a strong Indian look, which is increased when viewed in front, and shows that the aboriginal artist was attempting to carve in stone a portrait, or at least, that he had succeeded in presenting the characteristic features of the Red Indian. The streaks of black paint

*AMERICAN NATURALIST, vol. II, p. 388.

above and below the eyes, the black eye-balls and scalp-lock, give to it a hideous look which, perhaps, caused it to be looked upon with reverential awe by its superstitious aboriginal owner, or the modern Indian who perhaps found it, a relic of some older race, and finished it to his own liking by the addition of the black paint. A glance at fig. 138, which is a back view of fig. 137, shows that the primitive artist preserved as far as the nature of his design would admit, the general plummet form shown in the other implements

Fig. 137. Fig. 138.

Dark Limestone (nat. size). Back view of Fig. 137.

figured, while the slight groove around the small end shows plainly that it was to be suspended by a string, and I think fully warrants the conclusion that this implement is but a modification of the plummet, and that they were all used for the same purpose. It was found on the surface near the Illinois river, in Scott County and is now in my possession. Upon the left side a small piece represented by the dotted lines, is broken out and lost. When this is restored as seen in figure 138, the regular oval form of the plummet implements is plainly seen, when viewed from behind.

I can imagine six different uses which *might* have been made of these implements.

1st. They might have been used as sling shots, a string being attached to the weapon and to the wrist, while the implement itself was grasped in the hand. While it would make a very formidable weapon by the addition of weight to the fist, or by holding to the string and striking with it, after the manner of civilized roughs, a war-club would be much more formidable, and would be preferred where there was no motive for concealment; besides, it requires a considerable degree of civilization to invent and fully appreciate the virtues of a sling shot! The Brown County implement (Fig. 134) is evidently too small for anything of this kind, unless, like the little flint arrow points, it was used by the small boys.*

2d. They might have been used as sinkers for fishing tackle. Schoolcraft seems to think that the Penacook implement (Fig. 135) was used by that tribe for this purpose. If this is correct, it does not prove that they were originally intended for that purpose. I myself, by casting, made of lead an exact counterpart of fig. 132, and used it for a sinker for a trout line, and it answered the purpose admirably. I did not try the original implement, because of the danger of losing it, the smallness of the groove rendering it impossible for the fingers of a white man to attach it so firmly to the line as to remove the apprehension of its loss. The amount of labor bestowed on the Marietta, Quincy and Woodbridge specimens, and the inability to fasten them securely to a line, on account of the smallness of the groove, would lead us to believe that they were not used for this purpose.

3d. They might have been used in playing some game, but this is only a possibility. We have no account of any game played by either savage or civilized men (so far as I know) in which any instrument of this kind is, or could be, used.

4th. They might have been used as a sacred implement in the

* Since writing the above I have met with the following description of a sling-stone. "The Indians that inhabit still farther to the westward, a country which extends to the South Sea, use in fight a war-like instrument that is very uncommon. Having great plenty of horses, they always attack their enemies on horseback, and encumber themselves with no other weapon than a stone of middling size, curiously wrought, which they fasten by a string, about a yard and a half long, to their right arms, a little above the elbow. These stones they conveniently carry in their hands till they reach their enemies, and then swinging them with great dexterity, as they ride full speed, never fail of doing execution."—*Carvers' Travels in North America.* 1776, p. 188.

performance of some religious ceremony. This, like the preceding supposition, is only a possibility, there being no evidence whatever from which we are warranted in deriving such an inference.

5th. They might have been worn as a personal ornament. If they were used for this purpose, it would seem to me that implements worked out of iron ore, with the amount of labor which was bestowed on the Quincy specimens, would be ornamented with lines or figures. Their very plainness would seem to indicate the practical use for which they were intended. Besides, the weight of those made of iron ore would, at least, in the estimation of a white man, render them inconvenient personal ornaments.

6th. They might have been, and probably were, used for plummets. Their shape and the groove at the small end suggest at once, to the eye of a civilized man, that they were used in the first instance for obtaining a perpendicular line, and then as a level by drawing a horizontal line, at right angles with the first. This would easily be accomplished by the use of a wooden or other square. It has been suggested, that from the nature of the aboriginal ruins throughout the United States, the primitive people who made these implements would have had no use for plummets but it seems to me that the fact that this implement can also be used as a level, has escaped attention. Indeed the plummet, suspended to an upright fastened to a horizontal bar, is used among us as a level. That the mound builders had the ability to make the square above suggested, we know from the mathematical accuracy of squares and circular enclosures of earth found everywhere in the Mississippi Valley. Whatever might have been their use, their great antiquity will not be questioned. The Brown County, Woodbridge and Table Mountain specimens indicate that they rank among the very oldest relics of man found upon this continent, while from that found in the mound at Marietta, we see that they were at least not unknown to the mound builders, and, if Schoolcraft is right, the Penacook specimen shows it to have been used by the modern Indian.

[EDITORIAL NOTE.—These "plummets," or "sinkers," as they are more commonly called in New England, are of quite common occurrence in the vicinity of Salem, and we have in the collection of the Academy quite a number of specimens varying in size from an ounce or two to several pounds in weight, but all made on the general pear-shaped pattern, though they exhibit about as many modifications within the shape as shown by the hundreds of varieties of the pear itself. Local archæologists here in general consider them as "sinkers," principally from their shape and from the fact that they are more often found along the seashore than in the interior, though not unfre-

quently met with at a distance from the coast. The very large size of some of the specimens would perhaps indicate some different use from any proposed by Mr. Henderson, and in fact some of them run so decidedly into the group of implements classed as "pestles" that it is almost impossible to draw the line between the two groups, which are well marked by their extremes. The peculiar shape of these instruments has also caused them to be regarded as weights, used to stretch the thread in spinning. This supposition is rendered very probable by the fact that stone weights have been used in spinning, and from the statement (made to me in conversation by Dr. Palmer of Washington, I think) that similar stones are still in use among the Indians of the Northwest. As it is generally accepted that the Mound Builders were informed in regard to the spinning of fibre of some kind, and certainly of the *twisting* of materials which they could manufacture by some process akin to weaving, the use of these implements as weights seems very probable, and as household implements they would often be more or less elaborately finished or carved. For my own part I have for some time considered them as representing, to a greater or less extent, according to size, material, shape and finish, 1st, Pestles, 2d, Sinkers, 3d, Spinning weights, 4th, Ornaments. That their principal use was as "plummets" may be perhaps questioned, as there are far too many of them found, and of too great a variation in size, to lead us to infer that they were used mainly for that purpose. Though if it was necessary, in ancient architecture, to establish a perpendicular line, the implements were at hand as "weights" with lines attached.—F. W. PUTNAM.]

CONTRIBUTIONS TO THE NATURAL HISTORY OF THE VALLEY OF QUITO.—No. III.

BY PROF. JAMES ORTON.

ARTICULATES.

OF crustaceans, the only representative, we believe, is a small cray-fish abounding in the filthy, stagnant waters about Quito; its name is undetermined.

In regard to the character of the insect fauna of the Valley, we quote from a letter addressed by Andrew Murray, Esq., to Dr. Packard. "It is thoroughly Columbian. It would be natural to expect that northern types should run down the Andean chains, at high elevations like Quito; but I have not found the effect to be so much the presence of such types more there than in the rest of the Columbian district (in which they are very largely introduced as I think), as the absence of tropical looking species, which occur lower down in Venezuela, Cayenne, etc. Not that there are not large and gorgeous species, but that the mass seems minute in size and of little brilliancy, but still such genera and forms as are also met with in Columbia itself."

The Valley is not rich in insects, and in this respect is in strong contrast with the Pacific and Napo slopes, where there is no lack of vegetation, heat and moisture. Collectors have generally confined themselves to these prolific regions, so that the Valley has not received the attention it deserves. Still more, they have generally failed to note the vertical and horizontal ranges of the species — important data in illustrating distribution and affinities. A systematic exploration of the equatorial Andes, such as has been given to Amazonia and Central America by Bates, Salvin and Godman, will throw much light on the migration and relation of species and the effect of physical barriers. Messrs. Hewitson, Walker, Butler and Murray have done most towards developing the entomology of the Quitonian highlands. The researches of Bates show that the north-western part of South America constitutes quite a distinct province, having a considerable proportion of species peculiar to itself and a general specific dissimilarity from the adjoining region of Guiano-Amazonia.

The insects of the Valley are not only few in number, but are dull; there is nothing, *e. g.*, to compare with the magnificent beetle *Chrysophora chrysochlora* of Napo, which is on the same line of latitude, but eight thousand feet lower. It would be interesting to know whether the generalization of Bates and Wallace, that coleoptera are brighter near the tropics than at the equator, is truer of the high altitudes than of the lowlands.

It would be premature to draw any geological inferences from our present data, but the change of species seems to show, as Bates observes, that the Columbian highlands (including the Andes of New Granada and Ecuador) were formerly separated from those of Guiana and Mexico.

The following list must be very incomplete.

Hymenoptera.

Bombus funebris Smith.
" robustus Smith.
Apis (sp.?)
Euglossa bombiformis Pack.
Anthophora pilifrons Pack.
Halictus rimosiceps Pack.
Scolia bisignata Pack.
Pompilus vinicolor Pack.
Montezumia Andeus Pack.
Ponera carbonaria Smith.
Augochlora fuscipes Pack.
Xylocopa (sp.?)
Vespa Peruana Sauss.
Hypoclinea ursus Mayr.

Lepidoptera.

Pyrameis carya Hübn.
Anartia amalthea Linn.
Thecla atymna Hew.
Dædalma inconspicua Butler.
Colias Semperi Reak.
Callicore eluina Hew.
Amphirene Epaphus Latr.
Euptychia nossis Hew.
" harmonia Butler.
" tiessa Butler.
" Enyo Butler.
" jesia Butler.
" libya Linn.
Catagramma ceryx Hew.

Eueides eurysacus Hew.
Heterochroa collina Hew.
" ethelda Hew.
Satyrus Orchus Latr.
Hesperia carmenta Hew.
Heliconia hygiana Hew.
Leptalis avonia Hew.
Steroma Andensis Feld.?
" pronophila Feld.?
Devara (?) frigida Walk.
Epilais melda Boisd.
Bombyx mori Linn. (var.?)
Hyperchiria nyctimina Walk.
Eupyra regalis Boisd.
Tephrosia litharia Guen.
Urapteryx politia Cram.
Chœrodes tetragonata Guen.
Clysia succedens Walk.
Heterolocha ruminaria Guen.
Gypsara exularia Walk.
Scordylia unanimaria Walk.
Sybarites leptaliaria Guen.
Mocis notescens Walk.
Amphigonia insana Guen.

Diptera.

Pangonia ocellus Walk.
" testaceiventris Macq.
Tachina transiens Walk.
Tabanus auribarbis Macq.
" Peruvianus Macq.
Pulex irritans Linn.
" penetrans Linn.

Coleoptera.

Oxygonia Vuillefroyi Chaud.
Deltochilum Burmeisteri Har.
Uroxys elongatus Har.
Anomala marginicollis Deyr.
Phanacus (velutinus Murr. ?)
Chalepus Zoilus Burm.
Golofa (sp.?)
Colinus subviolacra G. and P.
Chalcolepidius limbatus Esch.
Lampyris (sp.?)
Astylus lateralis Buq.
Callichroma velutina Fabr.
Steirastoma brevis Linn.
Elytrosphæra fulminigera Deyr.
Hippodamia (sp.?)
Podischnus Agenor Burm.?
Diabrotica Saundersi Baly.
Tæniotes marmoratus Thom.

Hemiptera.

Pediculus capitis De G.
Coccus cacti Linn.
Rhiginia immarginata Stal.
Tettigonia immaculata Walk.
" longipes Walk.
" stipata Walk.
" plumbea Walk.
" decorata Walk.
Triquetra sobria Walk.
Hoplophora proxima Walk.
Zammara (sp.?)

Orthoptera.

Disceratus nubiger Scudd.
Panacanthus varius Walk.
Phasma (sp.?)

Doubtless many species credited to "Columbia," "New Granada," "Ecuador" and the "Andes of Quito" occur in the Valley; but I have rigidly excluded all such in default of precise localities.* Want of certainty in a given case is indicated by an interrogation point. I have not attempted to eliminate introduced species. The jigger is confined to the lower, sandy localities, as at Ambato. In my ascent of Pichincha, I observed large flies near the summit (fifteen thousand five hundred feet) but am unable to give the name. The spiders, of which a hairy species (*Mygale*) occurs at Quito, are also undetermined.

PLANTS.

While the east and west slopes of the Ecuadorian Andes are covered with a rich, subtropical vegetation, the Valley between the

* Kirby gives a list of 227 Diurnal Lepidoptera from "Ecuador."

Cordilleras, including their synclinal sides, is singularly barren. The birch-grove of Baños and the cinchona wood of Loja furnish the nearest approach to a forest. Herbaceous vegetation predominates over the arboreal. The "plain," or bottom of the Valley, is generally covered with vast quantities of volcanic ashes, mud and trachyte, with little to relieve the dreary landscape but hedges of agave, cactus and heliotrope. The neighborhood of Quito is the most verdant part of the whole basin. The paramos are treeless, rolling steppes on the shoulders of the mountains, having an average elevation of twelve thousand feet, and overgrown with *paja*, a species of Stipa. High up, reaching even to the snow-limit, is the peculiar shrub *chuquiragua*, while the gulleys are sprinkled with rigid tufts of Valeriana, Viola and Geranium. The last zone of vegetation consists chiefly of yellow-flowering *Compositæ*, the ruling order throughout the Valley. Last of all the trees is the Polylepis, reaching the altitude of nearly fourteen thousand feet. The most common tree in the Valley is the "Aliso" (*Betula acuminata*); and the most abundant moss is the *Tayloria erythrodonta.* Flowers are found in Quito all the year round, but the most favorable months are December and May. Yellow and blue are the predominating colors. The higher the altitude the brighter the hues of any given species. Thus, the *Gentiana sedifolia* is a small, light blue flower in the lowlands, but on the Assuay it has bright blue petals three times as large and sensitive.

The following facts noticed by Kerner in a special study of the Tyrolese Alps are observable on the Quitonian Andes: (1) The very small number of annual plants, bearing to perennials the proportion of four to ninety-six, while in the Mediterranean district it is forty-two to fifty-eight. (2) The large proportion of Alpine plants with rosettes of fleshy or succulent leaves, as Gentians, Saxifrages,* etc. (3) The poverty of the Alpine flora in plants having stores of underground nourishment in the form of bulbs. (4) The almost entire absence of climbing and creeping plants. (5) The large proportion of flowers of intense hues. (6) The deficiency of spiny and stinging species.

To this I may add what is characteristic of insulated tablelands as well as oceanic islands, the remarkable absence of large groups of plants; in other words, the great ordinal and generic diversity in proportion to the total number of species. As Hum-

* The *S. Boussingaultii* occurs on Chimborazo at the height of sixteen thousand feet.

boldt says: "The character of the flora of the elevated plateaux of Mexico, New Granada and Quito, of European Russia and of Northern Asia, consists, in my opinion, not so much in the relatively larger number of species presented by one or two natural families, as in the more complicated relations of the coexistence of many families and in the relative numerical value of their species."

The flora of islands and highlands are strikingly akin in their present features and also in their origin. Both resulted from migration, for since the great mountain chains are recent upheavals, evidently our Alpine plants must be only altered forms of lowland species.

The flora of Quito has some bearing on the question of a glacial winter within the tropics. The identity of many plants on mountain summits, separated from each other by hundreds of miles of lowlands where the Alpine species could not possibly exist, is well known. The peaks of the Alps and Pyrenees show a number of plants like those in Lapland, but nowhere found in the intervening plains. The flora of the top of Mount Washington is identical with that of Labrador. Mr. Wallace tells us that the isolated volcano of Pangerango, in Java (which has the same latitude and altitude as Quito), presents a vegetation closely allied to that of Europe, and Forbes has shown that the mollusca of Britain migrated during the ice period into the Mediterranean.

Mr. Darwin has explained these remarkable facts on the theory that as the cold of the glacial epoch came slowly on, and each more southern zone became fitted for arctic beings, and ill fitted for their former more temperate inhabitants, the latter would be supplanted by arctic productions and migrate into the tropics. In the New World it would follow that by the time the cold had reached its maximum, the now temperate regions of the United States would be covered by an arctic flora, while the plants indigenous to the latitude of New York would be driven into Mexico and the Isthmus;—as when our winter creeps down from the north, our summer birds travel southward. As the warmth returned, the arctic forms would retreat northward, while the temperate plants, unable to bear the returning heat of the tropical lowlands, would scatter,—many species returning to their old northern quarters, some of which could not survive the journey, perishing utterly, and others, naturally seizing upon the tropical

mountains, ascending higher and higher as the cold receded, till they found an asylum at the altitude where the climate corresponded with that of the latitude of their native home. As the tide leaves its drift in horizontal lines, so would the living waters leave their living drift in isothermal lines on the mountains of the equator.

If, then, a vast glacier covered North America from the Pacific to the Atlantic, and from the Pole to the Ohio River, or still more southerly, the depression of temperature would be sufficient to allow some temperate plants to sojourn in the Isthmus, and even to reach the equator. We should, therefore, look with some confidence for some remnants of our flora on the highlands of New Granada and Ecuador, or at least for some allied and representative forms. There would, of course, be some stragglers from the south: but, as Hooker has remarked, many more plants have migrated from the north to the south, than in a reversed direction. We have excellent evidence, says Darwin, that the glacial epoch was an enormous age, so that there was time enough for such a migration. Doubtless, there was time also for modification, and some of these wanderers might exist in their new habitat, as new varieties, or even distinct species. Still they would be plainly related to their brethren of the Temperate Zone.

The climate of North America 36° 30′ and northward corresponds to the climate of the equatorial Andes at the altitude of eight thousand feet and upwards. The intervening land of Central America is too low and tropical to allow the passage of temperate plants by ordinary migration. But if this region was turned into a temperate zone in the glacial epoch, the chasm is bridged. Comparing the exogenous flora of the Valley of Quito with that of our Northern States east of the Rocky Mountains and eliminating those species which occur in both localities, but are indigenous to neither, such as chickweed (*Stellaria media*), strawberry (*Fragaria vesca*), goose grass (*Galium aparine*), mudwort (*Limosella tenuifolia*), black night-shade (*Solanum nigrum*), pansy (*Viola tricolor*), and peppermint (*Mentha piperita*), we find the following which are native to the United States, and also occur at Quito:— (1) The bellwort (*Specularia perfoliata*). This is a temperate plant, and would not be likely to endure the transit of the tropics as they now are. We may suppose it was intentionally introduced by the Quitonians, but this is not probable, as it is not

a showy or useful flower; or that it was accidentally conveyed to the valley, which is possible. He who doubts it must believe in a special creation or the glacial theory. (2) The evening primrose (*Œnothera biennis*); but as this is found only in the cultivated parts of the valley, it was doubtless introduced through Europe or down the western coast, as it occurs also in California. (3) The gymnosperm (*Ephedra Americana*) is found by the shores of Great Salt Lake, yet appears to be a native of Quito, though Dr. Torrey doubts their identity. (4) The *Erigeron gnaphalioides* of Gray grows in Texas and about Quito. I know no other species apparently indigenous to Quito and the United States.*

If we take a more general survey, we shall find that the largest order in Quito, as in the United States, is the Compositæ. But here the correspondence ends.

The following list of orders shows their relative importance in the two countries:—

United States.	*Quito Valley.*
1. Compositæ.	1. Compositæ.
2. Leguminosæ.	2. Scrophulariaceæ.
3. Rosaceæ.	3. Labiatæ.
4. Scrophulariaceæ.	4. Leguminosæ.
5. Ranunculaceæ.	5. Cruciferæ.
6. Labiatæ.	6. Rosaceæ.
7. Cruciferæ.	7. Ranunculaceæ.

The Compositæ have one hundred and fifteen genera in the United States, and fifty-six at Quito, nineteen of which are common to both, but no species alike. The Leguminosæ have fifty-four genera in the United States and just half that number in Quito, sixteen being common. The Scrophulariaceæ have thirty-five genera in the United States and fourteen in Quito, half of which are common; Cruciferæ, thirty genera in the United States and eight in Quito, six being common. Solanaceæ, thirteen genera both in the United States and in Quito, four of which are common. There are twenty-three species of Eupatorium in the United States and twenty-four at Quito—all different. Our country is remarkable for its Solidagoes, outnumbering those of any other region; in the whole valley of Quito there is not one.

* It is fair to state that according to Hooker, sixty Arctic American species of phænogamic plants are found on the tropical mountains (probably of Mexico); but it is fair to ask why none of our hardy, diffusible plants—our daisies, thistles and golden rod were pushed across the Isthmus and left on the mountains of the equator. *Trisetum subspicatum* is common to both regions, but occurs also in Tasmania.

The botany of our Pacific states (California and Oregon), so far as it is known, reveals no nearer affinity to that of Quito — although the near relatives of Californian plants, when they have any in other lands, are in the Mexican plateau. Quito has plenty of Bignoniads, Acanthads and Lobelias; on our Pacific slope there are none. In Quito the Compositæ are mainly Heleniæ; on our Pacific coast there are few, if any, Heleniæ, but the order tends chiefly to Senecionidæ.

The recent researches of Griesbach prove the absence of temperate American species or types of plants on the loftier mountains of the West Indian Islands. These rise in Jamaica to eight thousand feet, and yet with the exception of a few naturalized plants, as *Fragaria vesca*, *Ranunculus repens*, etc., we find scarcely any North American temperate genera or species. Of nearly eleven hundred West Indian genera, only thirty are decidedly northern. This almost total absence of typical North American plants in the highlands of the West Indies, is a feature incompatible with their having shared in the effects of a glacial migration.*

[Parts I and II of these "Contributions" are given in Volume V of the NATURALIST, commencing on pages 619 and 693. — EDS.

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* *Appendix.* The Weasel, *M. aureoventris* Gray, mentioned on p. 622, Vol. v, is probably from the Valley. The following *Birds* should be added to the list given in the NATURALIST, Oct. 1871, Vol. v, p. 623; —

Pheuticus aureoventer Scl.
Tyranniscus nigricapillus Lafr.
Orthoëca citrinifrons Scl.?
Micocerculus gratiosus Scl.?
Leptasthenura andicola Scl.
Stenopsis ruficervix Scl.
Nyctibius Jamaicensis Gm.?
Eutoxeres heterura Gould.
Chlorostilbon melanorhynchus G.
Panoplites Mathewsi Lodd.
Heliangelus micraster Gould.
Cynanthus cyanurus Steph.
" mocoa D. et B.
Phaëthornis yaruqui Bourc.
Heliotrypha Parzudakii L. et P.
Petasophora iolata G. et M.
" cyanotis Bourc.
Bourcieria torquata Boiss.
Urochroa Bougieri Bourc.
Sycalis arvensis *should read* Sycalis luteiventris Mey.

NOTES ON THE VEGETATION OF THE LOWER WABASH VALLEY.

BY ROBERT RIDGWAY.

1. THE FORESTS OF THE BOTTOM LANDS.

THAT portion of the valley of the Wabash River and its tributaries lying south of latitude about 38° 25′ contains a sylva peculiarly rich, and also remarkable for combining within one area many of the characteristic trees, as well as other plants, of the northern, southern and southwestern portions of the United States, besides supporting the vegetation common to the whole Atlantic region or "Eastern Province." In this section of the country many species of the botanical districts named, in receding from their several centres of abundance, overlap each other, or reach their latitudinal or longitudinal limits of natural distribution; thus with the beech, sugar maple, the various oaks and other trees of the north, grow the bald cypress, the tupelo gum and the water locust of the south, and the catalpa and pecan of the southwest; while other trees such as the buckeyes, honey locust, black locust, coffee-bean, etc., especially characteristic of the country west of the Alleghanies, reach here their maximum of abundance. At the same time other trees of more extended distribution, grow scarcely anywhere else to such majestic size as they do here in the rich alluvial bottoms, the deep soil of which nourishes black walnuts, tulip trees, sycamores, white ashes and sweet gums of astonishing dimensions.

The mixed woods of the lower Wabash Valley consist of upwards of ninety species of trees, including all of those which reach a maximum height of over twenty feet; these are distributed through about twenty-five orders and fifty genera. In the heavy forests of the rich bottom lands more than sixty species usually grow together, though in various localities different species are the predominating ones.

The trees which usually attain the largest size are the following species, named nearly in the order of their maximum size:—sycamore (*Platanus occidentalis*), tulip-poplar (*Liriodendron tulipifera*), pecan (*Carya olivæformis*), over-cup or bur-oak (*Quercus*

macrocarpa), "Spanish oak" (*Q. coccinea* var?), white ash (*Fraxinus Americana*), bald cypress (*Taxodium distichum*), sweet gum (*Liquidambar styraciflua*), black walnut (*Juglans nigra*), white elm (*Ulmus Americana*), honey locust (*Gleditschia triacanthos*), cottonwood (*Populus monilifera*), beech (*Fagus ferruginea*), shellbark hickory (*Carya alba?*), and white oak (*Quercus alba*). All of these often exceed one hundred and fifty feet in height, while the first three are known to go beyond one hundred and seventy-five feet, and no doubt sometimes nearly approach, if they do not actually reach, the altitude of two hundred feet. The principal trees of the second magnitude (*i. e.* which do not often grow more than one hundred feet high, and are more usually seventy feet and upwards), are hickories (*Carya sulcata*, *C. amara*, *C. tomentosa* and *C. porcina*), red oak (*Quercus rubra*), water oak or pin oak (*Q. palustris*), swamp white oak (*Q. bicolor*), swamp chestnut oak (*Q. prinos*), linden or bass-wood (*Tilia Americana*), sweet buckeye (*Æsculus flava*), sugar maple (*Acer saccharinum*), red maple (*A. rubrum*), silver maple (*A. dasycarpum*), black locust (*Robinia pseudacacia*), coffee-bean (*Gymnocladus Canadensis*), water locust (*Gleditschia monosperma*), black cherry (*Prunus serotina*), sour and tupelo gum (*Nyssa multiflora* and *N. uniflora*), blue ash (*Fraxinus quadrangulata*), black ash (*Fraxinus sambucifolia*), hackberries (*Celtis occidentalis* and *C. Mississippiensis*), black and yellow birches (*Betula nigra* and *B. lenta*), etc. Some of these trees, as the oaks and hickories, occasionally attain a very large size, equalling those of the first magnitude; but as a general thing, they do not grow much, if any, beyond one hundred feet in height.

The more abundant or characteristic of the middle-sized trees, or those usually growing from forty to seventy feet in height, are the following:—box elder (*Negundo aceroides*), fœtid buckeye (*Æsculus glabra*), persimmon (*Diospyros Virginicus*), catalpa (*Catalpa bignonioides*), red ash (*Fraxinus pubescens*), sassafras (*Sassafras officinale*), red or slippery elm (*Ulmus fulva*), winged elm (*U. alata*), mulberry (*Morus rubra*), butternut, or white walnut (*Juglans cinerea*), post oak (*Quercus obtusiloba*—not frequent in the bottom-lands), willow oak (*Q. phellos*—rare), and laurel oak (*Quercus imbricaria*). The underwoods, composed of small trees from twenty to forty feet in height, are chiefly of the following species: pawpaw (*Asimina triloba*), prickly ash (*Xanthoxylum America-*

num), hop tree (*Ptelea trifoliata*), stag-horn, smooth and poison sumacs (*Rhus typhina*, *R. glabra* and *R. venenata*), redbud (*Cercis Canadensis*), wild plums and choke cherries (*Prunus Americana*, *P. Pensylvanica* and *P. Virginiana*), hawthorns, or "red haws" (*Cratœgus coccinea*, *C. tomentosa*, *C. crus-galli*, and *C. flava*), crab apple (*Pyrus coronaria*), June berry (*Amelanchier Canadensis*,) witch hazel (*Hamamelis Virginica*), dogwoods (*Cornus florida* and *C. alternifolia*), Viburnum (*Viburnum lentago*), black haw (*V. prunifolium*), green ash (*Fraxinus viridis*), iron-wood, or hop hornbeam (*Ostrya Virginica*), hornbeam, or water beech (*Carpinus Americanus*), etc.

The shrubby undergrowth or "underbush" is extremely varied and often so dense as to be nearly, if not quite, impenetrable. In the bottom lands it is composed in the main of spice bush (*Lindera benzoin* and *L. melissœfolia?*) and buttonbush (*Cephalanthus occidentalis*), which are the predominating species, the former generally distributed, and the latter mainly confined to the banks and ends of lagoons; but both are mingled with other shrubs far too numerous in species to mention, or nearly replaced by dense brakes of the small cane (*Arundinaria tecta*), and rank herbaceous plants, in almost endless variety.

In the heavy forests of the bottom-lands, which in many places have entirely escaped the ravages of the axe, the magnitude of the timber is such as is unknown to the scant woods of the eastern states, the stiff monotonous pineries of the north or the scrubby growth of other portions. The river flows for the greater part between dense walls of forest, which stand up to the very banks, and generally screened in front with a dense fringe of willows, with a belt of cottonwood and sycamores behind it. Viewing this forest wall from the opposite side of the river, there is seen a compact mass of verdure, the trunks of the trees being often hidden by the fronting belt of willows, which are often overrun by luxuriant masses of wild grape or other vines, often falling down to the very water's edge, so that even the bank itself is wholly concealed. If the forest is viewed from a high bluff, it presents the appearance of a compact, level sea of green, apparently almost endless, but bounded by the line of wooded bluffs three to seven miles back from the river; the tree-tops swaying with the passing breeze, and the general level broken by occasional giant trees which rear their massive heads so as to overlook the surrounding miles of

forest. The approximate height above the ground beneath of the average tree-top level is about one hundred and thirty feet—the lowest estimate after a series of careful mèasurements—while the occasional, and by no means infrequent, "monarchs" which often tower apparently for one-third their height above the tree-top line, attain an altitude of more than one hundred and eighty feet, or approach two hundred feet.

Of the ninety to a hundred species of trees of the lower Wabash Valley, about seventy exceed the height of forty feet; forty-six (perhaps fifty) exceed seventy feet in height, and about thirty are known to reach or exceed the height of one hundred feet. Of the latter class, as many as nine are known certainly to reach, or even exceed, the altitude of one hundred and fifty feet, while four of them (sycamore, tulip-poplar, pecan and sweet gum), attain, or go beyond, an elevation of one hundred and seventy-five feet! The maximum elevation of the tallest sycamore and tulip trees is probably not less than two hundred feet.

Going into these primitive woods, we find symmetrical, solid trunks of six feet and upwards in diameter, and fifty feet, or more, long to be not uncommon, in half a dozen or more species; while now and then we happen on one of those old sycamores, for which the rich alluvial bottoms of the western rivers are so famous, with a trunk thirty or even forty, possibly fifty or sixty, feet in circumference, while perhaps a hundred feet overhead stretch out its great white arms, each as large as the biggest trunks themselves of most eastern forests, and whose massive head is one of those which lifts itself so high above the surrounding tree-tops. The tall, shaft-like trunks of pecans, sweet gums or ashes, occasionally break on the sight through the dense undergrowth, or stand clear and upright in unobstructed view in the rich wet woods, and rise straight as an arrow for eighty or ninety, perhaps over a hundred, feet before the first branches are thrown out.

The following summaries of measurements, made in the summer and fall of 1871, in the vicinity of Mt. Carmel, Illinois, and mostly within a radius of ten miles, will serve to show pretty well the usual size of the large timber in that neighborhood. The measurements in the first column do not by any means represent the real maximum height of these species of trees in the Wabash Valley, since it was not often that trees of the largest size were found prostrate so that the total height and length of the trunk

could be measured satisfactorily. Very many trees seen and for these reasons not measured would materially swell the figures in the first two columns.

TABLE OF MAXIMUM SIZE ACCORDING TO TAPE LINE MEASUREMENTS.

	Total Height.	Length of trunk to first branch.	Circumference at 3 to 5 feet from ground.
Sycamore (*Platanus occidentalis*).*	168	68	33¾
Tulip Poplar (*Liriodendron tulipifera*) †	182	91	23½
Pecan (*Carya olivæformis*)	175	90	16
White Ash (*Fraxinus Americana*)	144	90	17½
Black Walnut (*Juglans nigra*)	120	60	22
"Spanish Oak" (*Quercus tinctoria?*)	150	75	20
Bur Oak (*Quercus macrocarpa*)	162	70	21
White Oak (*Quercus alba*)	142	60	17½
Cottonwood (*Populus monilifera*) ‡	165	75	19
Honey Locust (*Gleditschia triacanthos*)	120	50	17
Sweet Gum (*Liquidambar styraciflua*) §	144	70	17
Red Maple (*Acer rubrum*)	108	70	11½
Bass (*Tilia Americana*)			17
Sassafras (*Sassafras officinale*)	95 !	75 !	7½
Mulberry (*Morus rubra*)	60	20	10

TABLE OF AVERAGE DIMENSIONS.

SYCAMORE (*Platanus occidentalis*).

Height	168	feet.	(Only one tree measured).
Trunk	18	"	
Circ.	28	"	Mean of 9 trees.

This is certainly the largest, both in height and bulk, of all the trees of the Mississippi Valley. Its form is very variable, the

*Only one tree measured for height, and this by no means a large one. I have been told on the very best authority of trunks forty feet in circumference.

† I know of one, not measured by myself, thirty-two feet in circumference, and have been told of a stump in Posey County, Indiana, which around the top is thirty-seven feet in circumference.

‡ The tallest cottonwoods are no doubt one hundred and eighty feet or more in height.

§ The tallest sweet gums are certainly 160–180 feet, perhaps much more in height, and with clear shafts of over a hundred feet in length.

trunk being sometimes a tall arrow-like shaft, equalling the finest *Coniferæ* in straightness and gradual taper, the first branches being ninety to a hundred feet above the ground; but oftener, on the other hand, it is short and bulky, ten, fifteen or even rarely twenty feet in diameter, and only fifteen or twenty feet high, where three or four gigantic trunks separate and rise into a lofty massive head. The tallest of these sycamores rise apparently for one-third their height above the tree-top level of the forest, and are thus probably not less than two hundred feet in height.

TULIP TREE (*Liriodendron tulipifera*).

Height	$142\frac{7}{19}$	feet.	Mean of 19 trees.
Trunk	$69\frac{4}{5}$	"	" " 20 "
Circ.	$19\frac{1}{3}$	"	" " 24 "

The second tree in size and very commonly of the above dimensions. The finest individual found prostrate was one cut for lumber near Timberville, Wabash County, Illinois; it measured one hundred and fifty-eight feet in total length, while the trunk was twenty-three feet in circumference three feet from the base, and eighteen feet in circumference at seventy-four feet further up, where the first branch grew; *the trunk perfectly sound and symmetrical throughout.*

PECAN (*Carya olivæformis*).

Height	170	feet.	Mean of 3 trees.
Trunk	85	"	" " 3 "
Circ.	$15\frac{2}{3}$	"	" " 3 "

One of the most symmetrical and majestic of all our trees; the trunk clean, straight and long, and the head spreading and slightly drooping, usually elevated sixty to ninety feet from the ground.

WHITE ASH (*Fraxinus Americana*).

Height	$140\frac{1}{2}$	feet.	Mean of 2 trees.
Trunk	$79\frac{1}{2}$	"	" " 3 "
Circ.	14	"	" " 5 "

Also one of our finest trees; the trunk long and slightly tapering, though generally less straight than that of the pecan and "Spanish oak," and with the top less spreading.

BLACK WALNUT (*Juglans nigra*).

Height	125	feet.	Mean	of	2	trees.
Trunk	50	"	"	"	"	"
Circ.	$18\frac{1}{3}$	"	"	"	3	"

Trunks of fifteen feet in circumference and forty or fifty feet long very common, so much so that in one locality in the "bottoms" five trees of this size stood within sight all at the same time in the thick woods.

"SPANISH OAK" (*Quercus coccinea* var?).

Height	$120\frac{2}{3}$	feet.	Mean	of	6	trees.
Trunk	$58\frac{1}{5}$	"	"	"	5	"
Circ.	$17\frac{1}{2}$	"	"	"	6	"

The most stately and symmetrical of all our oaks; trunk straight and columnar and top massive and dense, reminding one in its appearance of the pecan. A more usual size is one hundred and fifty feet high, the trunk fifty feet long and fifteen feet in circumference four feet from the base.

BUR OAK (*Quercus macrocarpa*).

Height	$119\frac{1}{5}$	feet.	Mean	of	5	trees.
Trunk	$42\frac{2}{5}$	"	"	"	"	"
Circ.	19	"	"	"	6	"

The most massive, in proportion to its height, of all our oaks.

WHITE OAK (*Quercus alba*).

Height	$115\frac{1}{6}$	feet.	Mean	of	6	trees.
Trunk	$48\frac{1}{3}$	"	"	"	6	"
Circ.	$14\frac{3}{4}$	"	"	"	8	"

COTTONWOOD (*Populus monilifera*).

Height	$142\frac{1}{2}$	feet.	Mean	of	4	trees.
Trunk	$61\frac{2}{3}$	"	"	"	3	"
Circ.	$15\frac{1}{3}$	"	"	"	6	"

SWEET GUM (*Liquidambar styraciflua*).

Height	$117\frac{3}{7}$	feet.	Mean	of	7	trees.
Trunk	$62\frac{1}{2}$	"	"	"	4	"
Circ.	$11\frac{7}{8}$	"	"	"	8	"

The tallest tree in proportion to its girth. The largest shafts are probably over one hundred feet, and the greatest circumference about seventeen or eighteen feet; while many trees no doubt exceed one hundred and sixty feet in height.

SASSAFRAS (*Sassafras officinale*).

Height	$71\frac{2}{3}$	feet.	Mean	of	3	trees.
Trunk	$52\frac{1}{2}$	"	"	"	2	"
Circ.	$7\frac{2}{3}$	"	"	"	3	"

Though usually considered one of the "underwoods," this tree is not unfrequently of these dimensions in very rich woods.

FOSSIL INSECTS FROM THE ROCKY MOUNTAINS.

BY SAMUEL H. SCUDDER.

SEVERAL years ago, Professor William Denton discovered in shales lying near the junction of the Green and White Rivers in Colorado (?), the first traces of tertiary insects on this continent. They were found in two distinct localities, sixty miles apart, the specimens from one place differing from those of the other, not only specifically, but also to a very great extent in the general character of the whole assemblage.* Reports of these discoveries attracted the attention of those who afterward explored parts of the Rocky Mountain region, and repeated inquiries were made concerning the exact location of the insectiferous beds. These explorations have resulted in the discovery of more fossil insects in the same general region by Mr. F. C. A. Richardson, who accompanied Major Powell's exploring party, and by Dr. Hayden in some of his numerous and fruitful researches. The latter brought home only three specimens, two flies and an ant, but the collections of the former are more numerous and afford material for the present notice.

Some doubt exists as to whether the insects discovered by Prof.

* See Proc. Bost. Soc. Nat. Hist., xi, 117-118. A detailed and illustrated Report upon these fossils, which Mr. Denton kindly lent for a long period of examination, will shortly be published.

Denton were found in Colorado (as stated) or Wyoming Territory. Those now under consideration purport to come from the latter district,* as stated in the subjoined letter to the editors, though far removed from the vicinity of Chagrin Valley or Fossil Cañon, the two localities explored by Professor Denton. About one hundred slabs, mostly of very small size, were brought away; these contain at least one hundred and seventy-five specimens, including in that number all the reverses. Of these specimens thirty-five cannot be referred with certainty to any subordinal group, since they consist merely of abdominal segments or blurred and distorted fragments, the affinities of which can only be rudely surmised. The remainder are referable to nearly forty species, belonging to the following groups, mainly arranged in the order of numerical superiority:

Diptera,	thirteen	species,	sixty-six specimens.
Coleoptera,	twelve	"	fifty-two "
Hymenoptera,	three	"	five "
Hemiptera,	two	"	four "
Orthoptera,	two	"	four "
Neuroptera,	two	"	two "
Arachnida,	three	"	six "
Myriapoda,	one	"	one "

Of the Diptera, one-half the specimens belong to a single or possibly two heavy-bodied species of small size, which, although invariably wingless, are presumed to be so only by mutilation, since exceedingly few wings are preserved on any of the stones; of the other half, two-thirds are *Tipulidæ* or *Mycetophilidæ*

*"I discovered and collected the fossil insects on the Green River in Wyoming Territory on the line of the Union Pacific Railroad about forty miles this side (east) of Salt Lake City. Or, to be more precise, the locality is five miles west of Green River City and on the railroad track. The latitude and longitude as near as I can make out from very imperfect memoranda are as follows, *Latitude* 41° 40′ north, *Longitude* 109° 50′ west. I had a short time previous found two very imperfect fossil insects but could find no strata nor spot where any number could be obtained. I was then with the courteous explorer, Major Powell, and left the fossils with him. I returned a short time after (on account of poor health), and, while looking for fossil fish and leaves, found a stratum some two or three inches thick exposed in a railroad cut from ten to twenty feet from the top rock or sandstone; the rock, as near as my memory will serve me, dips to the southwest at quite an angle. The shale or portion of the shale on which the insects are found runs in a circle from the northeast to the southwest, as if on the border of a small lake. I also noticed that the fish are not in a regular order as the insects, which cover a space about two feet wide and form a ring or belt around the lake as near as I could make out from the appearance. The fossil insects, fishes, leaves and fruit abound in that section but are being rapidly worked up, thanks to the diligence of our naturalists and the kindness of the Superintendent, Gen. Sickles of the Union Pacific Railroad, to whom I am greatly indebted."—F. C. A. RICHARDSON, *Pres. Chicago Natural History Society, Aug.* 5, 1872.

and include five of the species, while the remaining sixth comprises about half the species and belongs to various groups. Of the Coleoptera, fully one-half the species and about seven-tenths of the specimens belong to the *Curculionidæ;* the others mostly to the *Staphylinidæ* and *Carabidæ.* These two suborders, flies and beetles, comprise the bulk of the determinable objects — nearly six-sevenths of the specimens and more than five-eighths of the species. The Hymenoptera consist of a small ant, a Pteromalus-like insect, and one rather obscure form. The Hemiptera are represented by an insect resembling Issus and another apparently belonging to the *Tingidæ.* In the Orthoptera there are only legs of a Locustarian about as large as our common Phylloptera and a cricket, perhaps of the genus Nemobius. Two Phryganeids are represented by wings, one of them doubtfully located in this family. Of the gally worm and spiders little can be said.

The interest in these objects is greatly increased when they are compared with the others brought from the same region. In the first place, the shales from "Chagrin valley" and "Fossil Cañon," are dark gray in tint, while those containing the insects now under discussion are of a reddish clay-color; the former are much more closely grained and of a firmer texture, resembling lithographic stone, and the objects are consequently better preserved — indeed on some slabs the hairs along the edge of a wing in a Thrips may be counted.

Again, the faunæ of the several localities differ. We have already remarked in a previous paper that this is the case with the specimens from Chagrin Valley and Fossil Cañon, although the stones themselves are similar in character. *Mycetophilidæ* and other Diptera are found in both places, "but in Fossil Cañon, the variety and abundance are proportionately greater; the ants, the moths, the Thrips and nearly all the smaller Coleoptera are restricted to Fossil Cañon, while the larvæ come from Chagrin Valley." The same is true of Mr. Richardson's specimens; not a single species can be definitely referred to any of those found by Prof. Denton, and the assemblage of species is different: thus, a single fragment of an elytron is the only Curculionid in the Chagrin Valley shales, and probably it is generically distinct from all those mentioned above. The type of fly spoken of as so abundant in the shales collected by Mr. Richardson is represented in the previous collection only by a single specimen from Fossil Cañon,

probably belonging to a different genus. The two forms mentioned under the name of Issus, one from Richardson's shales and the other from Chagrin Valley, are not congeneric; and the same is probably true of the ants from these shales and from Fossil Cañon. It is in the *Mycetophilidæ* and *Tipulidæ*, however, that we find the closest resemblance between the different collections; in the comparative abundance and variety of these insects, the shales worked by Mr. Richardson may best be compared to those of Fossil Cañon, but in the former the specimens are too poorly preserved to make a close identification very satisfactory; the genus Dicranomyia is apparently found in all three localities. Comparing the assemblages of species, we find that Diptera and Coleoptera are the prevailing forms in each,* but that within these groups the types differ in a remarkable manner, according to their several localities; the Orthoptera and Neuroptera, the spiders and Myriapoda of the later discovered beds are wholly wanting in the earlier; the Lepidoptera and Physopoda are found only in Fossil Cañon, and no trace of ants appears in Chagrin Valley, though occurring in the other two places and also in the locality examined by Dr. Hayden.

These results should not surprise us, since in the two rich quarries of Œningen, Baden, one of which is only a mile distant from, and about one hundred and fifty feet above the other, the insects are found to be specifically distinct throughout. Probably some of these conclusions will be modified by a more searching study of the remains under examination; unquestionably they will be altered by further researches in the field; and certainly these tertiary beds of the Rocky Mountains appear exceedingly rich in insect remains, and are worth careful exploration; that they extend over several successive geological stages seems probable from the great diversity of character in these fragmentary collections, and also from Prof. Denton's statement that the shales in which they occur have a thickness of a thousand feet.

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* All the insects as a rule are rather small in size.

THE GEOLOGICAL AGE OF THE COAL OF WYOMING.

BY EDWARD D. COPE, A.M.*

IN his Geological Survey of Wyoming, Professor F. V. Hayden thus describes the great coal area of Wyoming. "About two miles west of Rawling's, springs begin to appear again, and at Separation *Platanus Haydenii*, *Cornus acuminata* and other undetermined species of plants occur. This point forms the eastern rim of a basin which extends about one hundred and ten miles to the westward. A new group comes in which I have named the Washakie group, from the fact that near this station are beds of calcareous sandstone and limestone, composed of an aggregate of fresh water shells. As they are mostly casts it is difficult to identify the species, but Mr. Meek has named the most abundant kind, *Unio Vasakei*. Soon after leaving Bitter Creek, coal strata of Eocene age rise to the surface from beneath the surface of the Miocene beds of the Washakie group, with a reversed dip. Here we find numerous beds of coal, and in the rocks above and below the coal, are great numbers of impressions of leaves, and in the clay, oyster shells of several species. At Black Buttes Station eight hundred and fifty miles west of Omaha, we find *Sabal Campbellii*, *Rhamnus elegans*, etc. At Point of Rocks farther west, *Platnus Haydenii*, *Cornus acuminata*, etc., occur. At Hallville the black slaty clays forming the roof of one of the most valuable of the coal beds of this region, are crowded with bivalve shells, two species of which Mr. Meek has named *Cyrena fracta* and *C. crassatelliformis*, regarding them as Tertiary. They are undoubtedly brackish water forms, and show a sort of middle position, that is middle or upper Eocene. That there is a connection between all the coal beds of the west I am prepared to believe, yet until much clearer light is thrown upon their origin than any we have yet secured, I shall regard them as belonging to any transition series or beds of passage between the true Cretaceous and the Tertiary. It will be seen at once that one of the most important problems in the geology of the West awaits solution, in detecting without a doubt the

* Read at the Dubuque Meeting of the American Association for the Advancement of Science. Aug., 1872.

age of the coal series of the west, and the exact line of demarcation between the Cretaceous and Tertiary periods." (Report 1870 pp. 164–5.) Thus Prof. Hayden left the subject at that time.

In passing over the region from Ft. Bridger to Black Buttes during the present season, I traversed successively the strata of the Bridger and Green River epochs. Near Rock Spring Station the coal group makes its appearance, rising from beneath the Green River strata, as it appeared to me without instrumental aid with some degree of uncomformability. This forms the western border of an upthrust of rocks of which Dr. Hayden has treated in the above extract. At Rock Spring eleven coal beds have been struck in shafting, of which the upper and thickest is ten feet in depth. The rocks are buff sandstone nearly worn, alternating with gray sandstones and shales. They descend again near Point of Rocks and remain nearly level at Black Buttes. At Hallville I obtained isolated scales of numerous species of fishes. At Black Buttes I learned that Mr. F. B. Meek had visited the neighborhood, and had discovered the bones of some large animal. I went to the spot and found fragments of large bones lying in a bed of fossil leaves. On excavating, other bones were obtained including sixteen vertebræ, the sacrum, both ilia and other pelvic bones, with ribs and bones of the limbs. The position of the bones was in a bed of gray sandstone, above one coal bed and below two. They were covered with the leaves which had evidently fallen upon them, and filled the intervals between them, and occupied the angles between the processes, the neural canal, etc., just as they had been pressed in when soft. The skeleton had fallen on the shore, for the leaf bed passed gradually into a shell bed, which included mostly thin bivalved species.

The pelvic and sacral bones, in fact every part of the skeleton proved the reptile to have been a Dinosaurian. The entire dorsal vertebra was twenty-eight inches in height and the ilium between three and four feet in length; both extremities are straight, the one massive, the other dilated and thin, with a superior process. It resembles that of Cetiosaurus more than any other but presents well defined differences. It is named *Agathaumas sylvestris*.

This discovery places this group without doubt within the limits of the Cretaceous period, and to that age we must now refer the great coal area of Wyoming. It is surrounded to the west and

south and perhaps to the north by Eocene Tertiary beds, and the appearance of the country indicates that a smaller lapse of time has separated the periods of their deposit than is usual. Nevertheless no traces of Cretaceous types of vertebrates have yet been found in any of these Tertiaries.

EFFECTS OF EXTRAORDINARY SEASONS ON THE DISTRIBUTION OF ANIMALS AND PLANTS.

BY PROF. N. S. SHALER.

WHATEVER throws any light upon the nature of the means whereby the changes in the character and distribution of organic forms have been effected, has for the student of geology the keenest interest. I therefore venture to call attention to the peculiar effects of the last year upon the forests and probably upon some of the animals of New England. The year preceding the winter of 1871–2 was one of the dryest on record in this region; the rainfall was not only much less than usual, but came in such a fashion as to leave the ground very dry when winter came. The snowfall during the winter was slight and did not lie well upon the ground, melting and drifting in such fashion as to leave a large part of the surface quite unprotected. In this state the long continued and steady cold froze the earth to a great depth, and at some points the frozen ground was found as far as five feet from the surface. Over the whole of New England it was doubtless deep enough to involve the whole of the roots of the vegetation of our forests. It is doubtful whether it was the intensity of the cold alone which produced the effects which have been observed all about us, but more likely that it was in large part due to the deficiency of sap in the plants, in connection with the low temperature; as the frost left the roots, they remained for some time in contact with relatively dry earth, thus causing a shock too great for their vitality to withstand. I do not see clearly just how the cold and drought coöperated in bringing about this destruction, though I have no doubt they worked together.

The tree which suffered most is the arbor-vitæ (*Thuja occidentalis*) for more than half of these are dead and a large part of those

yet alive are in a critical condition. The red cedar (*Juniperus Virginiana*) is also a great sufferer in some regions, most of the specimens being dead or dying, while in others the greater part are unhurt. The yellow and white pines (*P. mitis* and *P. strobus*) are also much injured in many places, though in most cases immediate death has not resulted. All the other coniferous trees about Massachusetts Bay have suffered more or less. The greatest amount of damage seems to have taken place in sandy soils. So far as I have been able to observe, the trees placed so as to receive the greatest amount of moisture have on the whole withstood the crisis the best. The deciduous trees appear to have come out without damage; I have not yet been able to find any evidence of unusual loss among them. The same may be said for our herbaceous plants which, so far as my limited knowledge goes, show no signs of damage.

The only change in animal life which I have noticed is the comparative scarcity of snakes. In about two hundred miles of walking in the fields and woods I have encountered but three; of course, in a matter where it is so difficult to be sure of comparative numbers in different seasons, it will not do to make positive assertions, but I am strongly inclined to believe that the same amount of walking would have shown me several times as many snakes in former years. I am sure that this is the first year that I have gone until July spending at least one day in the week in the open air, without seeing a black snake. Toads seem to me also much less common than usual.

The most interesting point in this connection is the question as to what would have been the effect of carrying this accident of climate a little further. Small as the destruction of forest trees is, it will doubtless add several per cent. to the deciduous trees of New England, and remove an equal amount of conifers. The conifers seem to be relics of an old time and not competent to wage a successful war with their younger and more elastic competitors, the oaks, beeches and other deciduous trees. Every gap that is made in our forests of cone-bearing species is filled not with their legitimate successors, but by forms from the other class of trees. Let us suppose that the shock of the last season had been great enough to kill off the whole of our pines, the result would have been a complete change in the character of our forests; oaks generally would take the vacant place. This would

affect the character of the undergrowth very materially, for the lesser plants of a pine wood are very different from those which flourish beneath oaks. This would have had a very great effect upon insect life, and more or less directly influenced the number and character of the birds and the mammals. Even the climate would be in some small measure influenced, for a pine forest retains the snow better than one which loses its leaves in the winter and thus tends to secure a more equable temperature in the region where it lies.

Thus we see that an accidental drought might bring about a change in the assemblage of vital conditions on the surface of the land, as great as those which, when recorded in strata, we accept as indicating distinct geological formations.

It may not be amiss in passing, to call attention to the fact that the rate of change in land life, as far as change depends upon variations of temperature, must be far greater than in the sea. The sea knows no such frequent accidents of heat, cold and moisture as are at work on the land.* The difference in these conditions is well measured by the range of migration of species. Our Liquidambars, Liriodendrons, and other forest trees of the Mississippi Valley have, during the later stages of the Tertiary period, ranged as far as Greenland, or through over forty degrees of latitude. The greatest range of marine forms, as far as I am aware, is not more than one-third this amount in the same limits of time.

It is very desirable that abundant observations on the influence of the last winter on animal and vegetable life should be put on record. The author of these remarks would be glad to hear communications on this subject. Any information of importance will be printed in this journal with the proper acknowledgments.

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* In one way marine accidents may produce great changes of temperature in the sea. This is readily conceived by the following example. The destruction of Cape Cod would lower the average summer temperature of the region about Vineyard Sound by twenty degrees or so. The result would be the expulsion from that region of at least one-fifth of the marine forms now found there.

REVIEWS AND BOOK NOTICES.

CORALS AND CORAL ISLANDS.* —This delightful book is not the work simply of a zoologist, or a physical geologist or geographer, but of one who combines to a remarkable degree the qualities of each. The book will interest and instruct not only the student in each of those departments of science, but so simple and yet so comprehensive is the author's presentation of an intricate subject that it will be pleasant reading to any one.

The names of Darwin and Dana will always be associated with the study of coral reefs, and it is pleasant to learn of the ingenuous and enthusiastic admiration with which the American speaks in the following passage of the earlier labors of the English naturalist:

"Our cruise led us partly along the course followed by Mr. Charles Darwin during the years 1831 to 1836, in the voyage of the Beagle, under Captain Fitzroy; and, where it diverged from his route, it took us over scenes, similar to his, of coral and volcanic islands. Soon after reaching Sydney, Australia, in 1839, a brief statement was found in the papers of Mr. Darwin's theory with respect to the origin of the atoll and barrier forms of reefs. The paragraph threw a flood of light over the subject and called forth feelings of peculiar satisfaction, and of gratefulness to Mr. Darwin, which still come up afresh whenever the subject of coral islands is mentioned. The Gambier Islands in the Paumotus, which gave him the key to the theory, I had not seen; but on reaching the Feejees, six months later, in 1840, I found there similar facts on a still grander scale and of more diversified character, so that I was afterwards enabled to speak of his theory as established with more positiveness than he himself, in his philosophic caution, had been ready to adopt. His work on "Coral Reefs" appeared in 1842, when my report on the subject was already in manuscript. It showed that the conclusions on other points, which we had independently reached, were for the most part the same. The principal points of difference relate to the reason for the absence of corals from some coasts, and the evidence therefrom as to changes of level, and the distribution of the oceanic regions of elevation and subsidence, topics which a wide range of travel over the Pacific brought directly and constantly to my attention." (Preface.)

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* Corals and Coral Islands. By James D. Dana, LL.D. New York. Dodd & Mead, 1872. 8vo, pp. 398. With maps, plates and numerous woodcuts.

The chapters treat of "Corals and Coral Makers;" the "Structure of Coral Reefs and Islands;" the "Formation of Coral Reefs and Islands, and Causes of their Features;" the "Geographical Distribution of Coral Reefs and Islands;" the "Changes of Level in the Pacific Ocean;" and "Geological Conclusions;" with an Appendix, giving explanatory remarks on geological time, radiates, protozoans and a list of the names of species in the author's report on zoöphytes, the latter prepared by Professor Verrill.

While the first chapter gives an exhaustive and richly illustrated account of corals and coral polyps, we pass to some of the more general results of the author's studies. In speaking "a good word for coral reefs," the dread of navigators, he remarks that besides affording fishing grounds and harbors, "the wide coral banks and the enclosed channels greatly enlarge the limits tributary to the lands they encircle. Besides being barriers against the ocean, they are dikes to detain the detritus of the hills. They stop the water of the streams and cause it to drop the silt they were bearing off, and thus secure an addition to the land. They prevent, therefore, the waste which is constantly going on about islands without such barriers; for the ocean not only encroaches upon the unprotected shores of small islands, but carries off much of whatever the streams empty into it. The delta of Rewa on Viti Levu, resulting from the detritus accumulations of a large river, covers nearly sixty square miles. This is an extreme case in the Pacific, as few islands are so large and consequently rivers of such magnitude are not common. But there is rarely a coral-girt island which has not at least some narrow plains from this source; and upon them the villages of the natives are usually situated. Around Tahiti these plains are from half a mile to two or three miles in width and the cocoa-nut and bread fruit groves are mostly confined to them."

After having shown that atolls, and to a large extent other coral reefs, are registers of change of level, he shows that a large part of the Pacific Ocean must have undergone great oscillations in recent geological time. As proofs of elevation, he cites (1) "the existence on coral or other islands of patches of coral reef and deposits of shells and sand from the reefs, above the level where they are at present forming." (2) On islands not coral, the existence of sedimentary deposits, or layers of rolled stone, interstratified among the layers of igneous or other rocks constituting

the hills. "But the areas of subsidence, which covers an extent of fifty thousand square miles in the Pacific, and which commands so much interest from its bearings on geological questions, are indicated by" (1) "the existence of wide and deep channels between an island and any of its coral reefs; or in other words, the existence of barrier reefs; (2) the existence of lagoon islands or atolls; (3) the existence of submerged atolls; (4) deep bay indentations in the coasts of high islands as the terminations of valleys."

"Each atoll" says the author, "could we measure the thickness of the coral constituting it, would inform us nearly how much subsidence took place where it stands; for they are actually so many registers placed over the ocean, marking out, not only the sight [site] of a buried island, but also the depth at which it lies covered." As to the extent of the subsidence we are told—

"It is very evident that the sinking of the Society, Samoan and Hawaiian Islands has been small, compared with that required to submerge all the lands on which the Paumotus and the other Pacific atolls rest. One, two or five hundred feet, could not have buried the many peaks of these islands. Even the one thousand two hundred feet of depression at the Gambier Group is shown to be at a distance from the axis of the subsiding area. The groups of high islands above mentioned contain summits from four to fourteen thousand feet above the sea; and can we believe it possible that throughout this large area, when the two hundred islands now sunken were above the waves, there were none of them equal in altitude to the mean of these heights, or nine thousand feet? That none should have exceeded nine thousand feet in elevation is by no means probab'e. Hence, however moderate our estimate, there must be still allowed a sinking of many thousand feet. Moreover, whatever estimate we make that is within probable bounds, we shall not arrive at a more surprising change of level than our continents show that they have undergone; for since the Tertiary began (or the preceding period, the Cretaceous, closed) more than ten thousand feet have been added to the Rocky Mountains, and parts of the Andes, Alps and Himalayas.

Between the New Hebrides and Australia, the reefs and islands mark out another area of depression, which may have been simultaneously in progress. The long reef of one hundred and fifty miles from the north cape of New Caledonia, and the wide barrier on the west, cannot be explained without supposing a subsidence of one or two thousand feet at the least. The distant barrier of Australia is proof of great subsidence, even along the border of that continent. But the greatest amount of sinking

took place, in all probability, over the intermediate sea, called the "Coral Seas" where there are now a considerable number of atolls. The facts surveyed give us a long insight into the past, and exhibit to us the Pacific once scattered over with lofty lands, where now there are only humble monumental atolls. Had there been no growing coral, the whole would have passed without a record. These permanent registers exhibit in enduring characters some of the oscillations which the "stable" earth has since undergone."

While the island of Ponape is cited as affording evidence of a local subsidence in progress, the downward movement is not now general, and the period during which it took place "extends back to the Tertiary era, and perhaps still further back."

Geologists and palæontologists will be grateful for the grand generalization in the final chapter entitled, "Geological Conclusions." Facts bearing in an interesting way on lithology are stated in the section on the "Formation of Limestones," where the writer concludes that the "reef-formations illustrate that not only coral conglomerates, or *coral-rag* may be made of corals, but also the very finest and most compact unfossiliferous limestones; that fine compact limestone, as flint-like in fracture as any of Silurian time, is one of the most common of coral-reef rocks and is nothing but consolidated mud, or fine sand of coral origin."

These coral-reefs, which through subsidence became in some cases at least two thousand feet thick, are happily termed "beds of limestone with living margins," the living part furnishing material for its horizontal extension outward, and also, if a slow subsidence in progress, for its increase upward. "In the case of existing coral-reefs, there is yet no evidence that the species of the lower beds differ from those of the top. There is also no evidence, in any part of any ocean, that there is a set of cold water corals fitted to commence a reef in deep water and build it up to such a level that another set of species may take it and carry it up higher; the facts thus far gathered are all opposed to such an idea. Should it be hereafter proved that the corals of the inferior beds differ in species from those now existing, it will probably be found that the predecessors of those now living were also shallow water species; so that the subsidence in any case was necessary."

We now come to the solution of some questions bearing on the theories held by perhaps the majority of naturalists, that the present ocean beds were formerly continents. So far as we are

aware Professor Dana was the first* to call attention to this popular fallacy, which gives rise to so much crude theorizing to account for the present distribution of life and land on the surface of the globe. He shows from the fact "that the sediment or débris from a shore is almost wholly thrown back by the waves against the land where it originated, or over its submerged part in the shallow waters, and that is not transported away to make deep sea formations," the important conclusion that "lands separated by a range of deep ocean cannot supply one another with material for rocks. The existence of an Atlantic ocean continent—an Atlantis—has sometimes been assumed in order to make it a source of the mud, sand, and gravel, out of which the thick sedimentary formations of the Appalachian region of North America were made. But if this Atlantis were a reality, there would still have been needed, in addition to the presence of such an ocean continent, a set of freight carriers that could beat off the waves from their accustomed work, and push aside the ordinary oceanic currents; or else Atlantis would get back all its own dirt."

Professor Dana reasons from the existence of a Jurassic coral reef in England, that the "Gulf Stream has had, from the Jurassic period in geological history onward, the same kind of influence on the temperature of the north Atlantic ocean which it now has." Before the Cretaceous period began the waters cooled somewhat, as there were no coral reefs in the British Cretaceous sea, though as late as the Miocene Tertiary, there were reef corals in the seas of northern Italy.

"The absence from the American coast of the Atlantic, of any coral reefs of the Cretaceous beds, and of any reef corals, seems to show that the oceanic temperature off this coast was not favorable for such corals; and if so, then the line of 68° F. extended at least 20° further north on the European side of the ocean than on the Atlantic—an inequality to be accounted for only by the existence of the Gulf Stream. But, in addition, the whole range of life in the European Cretaceous, and its vastly greater variety of species leave no doubt as to the higher temperature of the ocean along its European border; so that the idea of a Cretaceous Gulf Stream must be accepted, and that of a Tertiary is demonstrated by similar facts.

If the Gulf Stream had its present position and force in Oölitic, Cretaceous, and Tertiary times, then the ocean had, throughout these eras, its present extension and oceanic character; and,

* Proceedings Amer. Assoc. Adv. Science, 1856.

further, no barrier of land extended across from South America to the Canaries and Africa, dividing the South from the North Atlantic, but all was one great ocean. Such a barrier would not annul entirely the flow of the Gulf Stream; yet the North Atlantic is so small an ocean, that if left to itself its system of currents would be very feeble."

We would have liked if space allowed to reprint the whole of the section entitled "The Oceanic Coral Island Subsidence." We reproduce portions, however, for the most part in the author's own words. While he has shown that coral islands are records of slow changes of level in the ocean's bottom, they are also records of the contour of the ocean bed, as they indicate submarine linear ranges of mountains "the whole over five thousand miles in length," the whole area of subsidence being over six thousand miles in length, with a width equalling that of North America, thus forming an example of one of the "great secular movements of the earth's crust." The subsidence was in progress during the Glacial era, while the more northern continental lands, "at least those of North America," were being elevated, preparatory to, or during that era of ice: and this elevation of land northward "may have been a balance to the *downward* oceanic movements that resulted in the formation of the Pacific atolls."

There was a similar subsidence in the West Indies. "The peninsula of Florida, Cuba, and the Bahamas look, as they lie together, as if all were once part of a greater Florida, or southeastern prolongation of the continent." Professor Dana believes that a very large number of islands, more than has been supposed, lie buried in the ocean, and he cites the interesting example of the "lonely Bermuda atoll." "Its solitary state is reason for suspecting that great changes have taken place about it; for it is not natural for islands to be alone."

We quote the following paragraph, believing, that it is the key to many of the laws of geographical distribution of plants and animals, as it opposes many crude theories of the existence of former continents and continental bridges which naturalists assume to account for the present distribution of life on opposite shores of our present continents:—

"While thus seeming to prove that all the great oceans have their buried lands, we are far from establishing that these lands were oceanic continents. For as the author has elsewhere shown, the profoundest facts in the earth's history prove that the oceans

have always been oceans. These lands in all probability were, for the most part, volcanic islands or summits of volcanic ranges, for of this nature are all the islands over the interior of either ocean that are not of coral origin."

The extracts we have given, rather than any words of the reviewer, attest the clear and comprehensive manner in which the author treats of a difficult and abstruse theme. The publishers have issued the volume in a most attractive style.

MAN IN THE PAST, PRESENT AND FUTURE.*—We are assured by the modest author of these lectures that their publication was the result of "the extraordinary favor which the public has hitherto manifested towards all the literary productions of the author without exception." They seem to be a digest, with liberal quotations, of the writings of Huxley, Schaffhausen, Vogt, Haeckel and others, on man and his origin. The main facts as to the antiquity of man are given, with a chapter on his simian origin, while the future of man occupies the last third of the book. We have not been able to find that the author is an original investigator in anthropology, and with his hearty contempt for philosophy and pity for any one who believes in such infantile notions forsooth as the immortality of the soul and the existence of God, we doubt whether his superficial mode of treatment is calculated to win the regard of his readers to anthropological studies.

The crude and sophomoric style of the third chapter is more subdued in those on the antiquity and origin of man. But even here in matters of detail the author is not invariably reliable. He accepts unhesitatingly the calculation as to the age of the portions of the human skeletons found in the "coral rock" of Florida, though it has been stated in this journal (vol. ii, p. 343, Oct., 1868) by M. De Pourtales, the original discoverer of the specimens, that they were not from a coral formation, but that he took them from a "fresh water sandstone on the shore of Lake Monroe, associated with fresh water shells of species still living in the lake. No date can be assigned to the formation of that deposit at least, from present observations." It has also been questioned whether the age of the bones found in the cypress swamps of Louisiana is so

* Man in the Past, Present and Future. A popular account of the results of recent scientific research as regards the Origin, Position and Prospects of the Human Race. From the German of Dr. L. Büchner, by W. S. Dallas. London 1872. Philadelphia. J. B. Lippincott and Co. 8vo, pp. 363.

well determined as Dr. Büchner seems to think. On the other hand he does not seem acquainted with the discovery of the human skull under Table Mountain in California, though these remains are probably more ancient than any human relics yet found in Europe.

Otherwise the work is a good digest of the leading facts and arguments on the scientific topics of which he treats, which the ordinary reader will not find in any available work.

The translation certainly does not gloss over the literary crudities of the original, while the book abounds in gross typographical blunders.

THE BIRDS OF THE TRES MARIAS AND SOCORRO ISLANDS..*—The Tres Marias form a group of several small, heavily wooded islands, situated off the Mexican coast, opposite the port of San Blas and about one hundred miles distant from that point. Socorro, the largest of the Revillagigedo group, is a barren volcanic island which rises abruptly to the height of two thousand feet, about three hundred and fifty miles southwest of the Tres Marias, and about the same distance from the Mexican coast. From their small size and their distance from the mainland, the fauna of these islands presents features of more than usual interest. Under the auspices of the Smithsonian Institution and the Boston Society of Natural History, Col. Grayson made several voyages to these islands for the purpose of exploring their natural history. In the present paper we have some of the results of Col. Grayson's labor, prepared from his notes and collections by Mr. George N. Lawrence. The paper contains copious and valuable notes respecting most of the species mentioned, with quite a full account of the physical characteristics of the islands. The Tres Marias list embraces fifty-two species, collected by Col. Grayson in 1865, 1866 and 1867. In general character the avian fauna of these islands closely resembles that of the adjoining main, though several strongly marked insular races are easily recognized, and is hence decidedly tropical. The only northern United States species recorded are such as have a wide range of distribution or are semitropical, the majority being raptorial birds. But one aquatic species (the sooty tern) is given,

*On the Physical Geography and Natural History of the Islands of the Tres Marias and of Socorro, off the western Coast of Mexico. By Col. Andrew J. Grayson. Edited by Geo. N. Lawrence, Proc. Bost. Soc. Nat. Hist. Vol. xiv, pp. 261-303. April, 1872. (Read June 7, 1871).

contrary to what one would anticipate, and the waders number only six species. Seven hummingbirds are reported, five being given by Mr. Lawrence on the authority of Capt. J. Xantus. The list is hence evidently more or less incomplete, Col. Grayson mentioning only such as he actually obtained or observed. Unfortunately no dates are given in the notes, and we are hence left in doubt as to the season of occurrence of the birds mentioned.

Socorro Island was visited twice by Col. Grayson, but the chief part of his collections there seems to have been made during the last ten days of May, 1867. The list embraces fourteen species, only five of which were found at the Tres Marias. Several appear to be known as yet only from this island,* and others only from this and the Tres Marias, though each has near relatives on the Mexican main. Among those of special interest obtained here were several specimens of Whitney's owl (*Micrathene Whitneyi* Coues) known formerly only from the single specimen obtained by Dr. Cooper at Fort Mohave, in 1861, but since found also at Mazatlan by Grayson, and in Arizona by Bendire.

The itinerary† given of Col. Grayson's voyages on these expeditions conveys a vivid picture of the dangers as well as annoyance, to which the enthusiastic naturalist is often exposed in the pursuit of his treasures. Though shipwrecked at Socorro, he seems not to have been daunted in his explorations, but extending his researches to other localities, he fell a victim to a fever contracted while collecting at the Isabel Islands, in the summer of 1869.‡ To Col. Grayson ornithologists are chiefly indebted for our present knowledge of the ornithological fauna of northwestern Mexico, and in his death science lost a devotee of rare zeal and industry. —J. A. A.

BOTANY.

Law of Angular Divergence in the Branches of Plants.— Mr. Thomas Meehan said that of all the problems that faced the botanist, few seemed more impenetrable than the law which governed the angular divergence in the branches of plants. Some grew quite prostrate and others, though closely allied species, might be strictly erect. At the present season of the year we may

* See Ann. Lyc. Nat. Hist. N. Y. x, pp. 1-18, March, 1871.
† Also published in the "Overland Monthly," September, 1872.
‡ See "Overland Monthly," February, 1870.

note plants with prostrate leaves or branches, which in spring will have them of a sharp, upright angle. The Verbascums at the present time, especially *V. blattaria*, had their root leaves so firmly pressed against the ground, that on lifting they would fall back with a spring; as soon as the central axis grew, the leaves from that would be almost upright. In some respects, erection or prostration became almost specific characters. The *Rubus villosus* usually grew erect even from infancy, and the *Rubus Canadensis* generally trailed; yet the last named would sometimes throw up strong erect stems, which could scarcely be distinguished in that stage from *R. villosus*. Again, the same species of tree would often produce individuals quite erect, and at other times very pendent, and hence we had in horticulture the class of weeping trees. All trees seemed to have this power of producing pendent individuals. The oaks, ashes, poplars, elms, all furnished familiar examples.

It was usual with botanists to pass these things over as "weaknesses." But the term weakness explained nothing. To say that these plants had lost the power of erection was simply restating the primary fact. Moreover, some of these prostrate forms had apparently more vigor than the erect ones. *Rubus Canadensis* was weaker than *R. villosus*, truly; but, on the other hand, some of the Russian trailing junipers were far more vigorous than any of the upright forms. The weeping beech also was in appearance more vigorous than the ordinary forms. All beeches had their young growth pendent. As the growth matured, the branches became erect; but in the weeping form erection did not come with maturity, and hence it remained pendent. In the ashes, however, there was no pendency in the young growth; but the "weeping ash" was one of the most decided of all drooping trees. In such cases as these, the law which governed the angles of divergence must either be different in each case, or operate at different stages of the development of the branches.

In his late travels in the Rocky Mountains, he came on a tract covered profusely with one of the small creeping Euphorbias, probably *E. cordata*, in which a large quantity grew perfectly erect. Sometimes only a portion of the plant exhibited this character, at other times all the plant was upright. The specimens he exhibited were of the erect class. In all these cases the plant was attacked by a small fungus, *Æcidium euphorbiæ*, the *Æ.*

hypericæfolia of Schweinitz. He thought that the fact that this little fungus should be able to make a usually creeping plant, rooting from every joint, entirely lose this character and become erect, was worthy of some notice by students in this branch of botany.—*From remarks made before the Philad. Acad. Sciences.*

Classification of the Gray Pine.—In the last edition of Gray's "Manual," the gray pine (*Pinus Banksiana* Lambert) is classed, according to Dr. Engelmann's arrangement of the species, with *P. inops* Ait. and *P. mitis* Michx., etc., in the group with the fertile catkins and cones lateral. Now, at Tawas Point, Michigan (Lake Huron), I find (June, 1872) this tree in an abundance of instances, with young, half-grown fruit, as well as others with female flowers, bearing them, one or a pair at apex, thus again a few inches lower down, and again farther down along that same branch.

It would be important to know how frequently the female flowers and the fruit are apical (*i. e.* above the leaves) and how often lateral. The facts here given would seem to require a correction in the classification of this tree, placing it, perhaps in an intermediate group, between the two groups already erected. Specimens sent by me to Dr. Engelmann have elicited his surprise as, though he had had plenty of material of *P. Banksiana* from Lake Michigan, he had none showing this disposition of the fruit.

The trees at Tawas Point are, for the gray pine, remarkably large; in many cases reaching the height of fifty feet, the trunk being frequently over a foot in diameter and occasionally eighteen inches through. The specimens collected, however, were from the more stunted usual form, ranging from five to twenty feet high, and which grow on the extremity of the point. I do not think the cones were either as frequently or as much curved as I have observed them to be on this tree further north, for instance at Marquette on Lake Superior.—Henry Gilman, *Detroit, Michigan.*

The Vegetable Nature of Diatoms.—The Rev. M. J. Berkeley notices in the "Academy" a memoir by Dr. Pfitzer on diatoms, which fully confirms the important observations which were made by Mr. Thwaites, and which "at once settled the question as to the vegetable nature of their singular organisms." The point of special interest in Pfitzer's paper is the elucidation of the mode in which the two portions of the outer silicious envelope

overlap each other, thus facilitating the multiplication of the individual as distinct from the fructification. Few matters are more interesting as regards microscopical observation than the mode of propagation, and when the different species of Biddulphia can be readily procured as on our southern coasts, they will afford ample food for many a morning's investigation. The two original halves remain exactly *in statu quo*, and it would be interesting to know how long they would subsist while new intermediate pustules are developed; and the same observation applies to many Desmidiaceæ.

Office of Bud Scales, etc. — Mr. Thomas Meehan referred to some observations made by him last spring before the Academy of Natural Sciences of Philadelphia in regard to the office of bud scales and involucral bracts. The general impression was that they were formed for the purpose of protecting the tender parts beneath. At that time he exhibited branches of *Fraxinus excelsior* on which some of the buds were entirely naked, and others clothed with scales in the usual manner. They could scarcely be for protection in this instance, as both were equally hardy.

He now had to exhibit an ear of corn which had been produced without the usual involucral bracts or husks, and yet was as perfect as if clothed in the usual way, showing that the husk was of not much importance as a protecting agent. An interesting point was that this ear had been formed on the end of a male panicle or tassel. It was not uncommon to find scattered grains of corn amongst male flowers, but a perfect ear like this he had never before seen. The ear was eight-rowed, and contained two hundred perfect grains. It was the variety known as "popcorn."

Seeds as Projectiles. — Mr. Thomas Meehan, at a late meeting of the Academy of Natural Sciences of Philadelphia, said that while travelling through a wood recently he was struck in the face by some seeds of *Hamamelis Virginica*, the common witch hazel, with as much force as if they were spent shot from a gun. Not aware before that these capsules possessed any projecting power, he gathered a quantity in order to ascertain the cause of the projecting force and the measure of its power. Laying the capsules on the floor, he found the seeds were thrown generally four or six feet, and in one instance as much as twelve feet away. The cause of this immense projecting power he found to be simply in the

contraction of the horny albumen which surrounded the seed. The seeds were oval and in a smooth bony envelope, and when the albumen had burst and expanded enough to get just beyond the middle where the seed narrowed again, the contraction of the albumen caused the seed to slip out with force, just as we would squeeze out a smooth tapering stone between the finger and thumb.

ALPINE FLOWERS.—Dr. Parry, having devoted the whole summer to a third botanical exploration of the Colorado Rocky Mountains, has prepared beautiful sets of the more remarkable and novel Alpine flowers of the region, consisting of above a hundred species. A limited number of these sets, interesting as *souvenirs* of travel as well as to botanists, may be obtained for twelve dollars a set upon application to Dr. Parry at Davenport, Iowa, or to the Naturalists' Agency in Salem.—A. G.

ZOOLOGY.

THE ZOOLOGICAL STATION OF NAPLES.—An undertaking which cannot fail to have an important influence on the progress of zoology has been started at Naples. A zoological station to be in charge of a permanent zoological observer and opened under certain restrictions to all workers who may wish to avail themselves of its facilities. It will form the natural complement of the advantages zoologists and anatomists now derive from the great zoological gardens of London and Paris, which constantly supply so much valuable material for study to the members of the Zoological Society of London and the Professors of the Jardin des Plantes. Hitherto all the work done on the seashore has necessarily been more or less interrupted; usually a stay of a few weeks at one place has been the utmost length of time which naturalists have been able to devote to one of the most fruitful branches of research in Zoology. Occasionally a more favored individual spends a few months on the seashore, but these are exceptions. All who have had occasion to pursue embryological studies on the seashore, or to trace the habits and study the anatomy of our marine animals, know how difficult it is to obtain just the material which is wanted. To make a complete embryology of a single marine animal often requires several years of unremitting devotion to one subject and, in order to obtain missing links, one must study on the

seashore what he happens to find. It is impossible to obtain certain stages of growth except at stated seasons, which are not always the time when the seashore is accessible. The value therefore of permanent stations cannot be overestimated. The zoologists in charge will little by little learn the habits of the more common species and by making the materials accessible to special research save an immense amount of time now devoted to exploring the ground. A zoological station on the seashore will become for biology, when fully equipped, the equivalent of first class observatories, and when other stations are established on well selected points along the coasts of different countries we may hope to gain the materials for the solution of many most interesting problems in Natural History which individual exertions could hardly hope to solve.

A better spot than Naples could not have been selected to make a start; rendered classic by the important memoirs which have been published upon the animals of its bay, the student will at once have a guide and models to follow.

May we not hope that the noble example given by Dr. Dohrn will be imitated in this country and that in connection with some of our leading Universities, Practical Schools of Biology will be established, where Professors and Students will find abundant material to pursue their favorite studies?—A. Agassiz.

The "Spener'sche Zeitung" (Berlin) publishes the following extract from a private letter:—On the narrow strip of coast which separates the park of the Villa Reale from the sea, a large stone building is at present being erected at Naples, quietly and almost unnoticed; at least the Neapolitan press has paid no attention to it. The strength of the foundations—it has taken three months to lay them—shows that they are intended for an edifice of considerable size and durability, and on making inquiries I have learned that this is the *Zoological Station* which has been occasionally mentioned by Italian, German and English journals during the last few months. It has been organized and is being built by a young German naturalist, Dr. Anton Dohrn of Stettin, who until a few years ago was a private teacher at the university of Jena. He has paid nearly the whole of the expenses, which amount to about 50,000 thalers (£7500) out of his own pocket, the only assistance he has received having come from a few personal friends, who have lent several thousands of thalers for the purpose. The following is a short sketch of his plan. The ground floor of the

building, which covers an area of about 8000 sq. ft., contains a great aquarium, which will be opened to the public. Dr. Dohrn hopes that the money thus obtained will not only suffice for all the expenses of the aquarium, but also afford a surplus to be employed in covering a part of the requirements of the upper story, which is to be exclusively devoted to scientific purposes. Besides the officials and servants employed in the aquarium, several young zoologists will be attached to the station and receive a regular salary from the Director, Dr. Dohrn. Thus a number of new positions will be opened up for young scientific men. But this is not all. As the only duty of these zoologists will be to devote themselves to certain branches of scientific work, and their exertions will be carefully directed and organized, as has long been the case in astronomical and meteorological observatories, there is every reason to hope that scientific research will be greatly facilitated and advanced by their labors. In the upper story of the Zoological Station, laboratories will also be prepared for the use of naturalists coming from other parts of Italy and from abroad. For this purpose a large scientific library will be founded, Dr. Dohrn's very considerable private collection serving as a nucleus; and about twelve tables fully furnished with the necessary appurtenances established. Each of the latter will be provided with a number of tanks supplied with a constant stream of sea-water. Sea fishing and dredging will be conducted on an extensive scale by means of several boats to which, if the necessary means are forthcoming, a small steam-yacht wi l be added. The animals taken will be given to the zoologists for scientific treatment. It is more than doubtful, whether all these rich and expensive conveniences can be furnished to zoological visitors without any pecuniary compensation, but I hear that Dr. Dohrn has drawn up a plan which will enable even naturalists of limited means to enjoy the advantages of the Station. He proposes to offer one or more tables to various Governments and scientific societies for a fixed annual sum. These tables and all the scientific resources of the Station will at once be placed at the disposa
cate from the government, un
table has been let. This pl
seems to be a successful att
to how it is possible to unite
part of scientific bodies with

from their Governments. Dr. Dohrn speaks in the most grateful manner of the assistance rendered him by the German authorities in Italy, especially by Mr. Stolte, the Consul-General at Naples, while at the same time he warmly acknowledges the interest in his undertaking, displayed by the government of Italy, more particularly by Signor Correnti and Signor Sella, the late and the present minister of Public Instruction. The difficulties in the way of the execution of his plans were neither few nor small, as may be gathered from the fact, that in spite of the readiness displayed by the municipal authorities of Naples, more than two years elapsed before a definitive contract could be concluded between the town and Dr. Dohrn with respect to the cession of a suitable site for the building.

[We are happy to add our testimony to the great value and importance of such a biological station as this. Late in May one of the editors of this journal visited the foundations of the Naples aquarium, and was surprised at the magnitude of the building, and the admirable natural advantages of the situation, and he predicts a grand success to the undertaking; the Italian government will undoubtedly cherish and protect the institution when its value shall be demonstrated. We hope that the success of this station may lead to the establishment of a zoological station on the American coast. Surely the zeal and money would not be wanting with us, if some one would take the lead; and such a station properly conducted and with due regard to popular wants, would be undoubtedly self sustaining. Indeed it is not a little surprising that public aquaria and zoological gardens on a large scale have not been established in the United States before this, as those of London, Paris, Hamburg, Berlin, etc., are, we believe, well sustained. — Eds.]

Faunal Provinces of the West Coast of America. — At a recent meeting of the California Academy of Sciences, Mr. Stearns called the attention of the members to certain provincial divisions in the marine faunæ of the west coast of America suggested by Prof. Verrill in the Transactions of the Connecticut Academy of Sciences for 1871.

Mr. Stearns remarked, more particularly regarding the coast from Cape St. Lucas northward, that to divide this portion upon the data at present made known, so as to make provinces which should correspond with those of the Atlantic side, is not warranted

by the knowledge possessed at the present time; that the topography and geology of that portion of the west American coast, specified by him, was much more uniform in its character, as well as in the temperature of its waters, than that of a corresponding section in extent of the Atlantic coast, to say nothing of the influence of the coast currents which upon our coast are peculiar, and which enter largely in the matter of distribution of species; furthermore that the manuscript data in his possession, which were, to say the least, fully as important as what had already been published, and quite likely more authentic, indicated a greater range of coast to each province and therefore a less number of provinces than suggested by Prof. Verrill.

Though much had been done by himself, and other members of the Academy cooperating with him, in the accumulation of data bearing upon the geographical distribution of the mollusca of our coast, still so much remained to be done in order to make the work thorough and reliable, that it would be merely arbitrary and necessarily require frequent readjustment to propose at this time any new divisions or subdivisions of the coast into zoological provinces.

As to that part of the west coast of North America from Cape St. Lucas, including the Gulf of California, thence southerly to a point a few miles south of Panama, with the exception of collections made at a few places in the Gulf of California, also at San Juan del Sur and its immediate vicinity on the coast of Nicaragua, and in the Bay of Panama, almost nothing more is known of this vast reach of shore line than was known years ago.

Mr. Stearns stated that at some future time, as soon as the data collected by himself and colaborers here could be compiled, he proposed to refer to this subject again.

On Zoological Barriers, with Special Reference to South America.—How far the present lofty mountain-chains and broad rivers arrest dispersion is an interesting and important question. Every fact throwing light upon it is a valuable contribution to science. It would seem that in temperate regions the mountains are greater barriers than in the tropics. Mr. Darwin says that we ought not to expect any closer similarity between the organic beings on the opposite sides of the Andes than on opposite shores of the ocean. My own observations on the equatorial Andes corrobo-

rate this statement, though it is more strikingly true of the Chilian Cordilleras and, as Mr. D. has remarked, is truer of quadrupeds and reptiles than of birds and insects. I know of fifty-six species occurring on both sides of the Andes of Ecuador, excluding all highflying Accipiters and all species ranging north of Panama. Of Mammals, one monkey and one pachyderm; of Birds, one thrush, two wrens, one vireo, five tanagers, two antcatchers, two flycatchers, five hummers, one trogon, one sawbill, and one wader; of Reptiles, ten ophidians, two saurians and one batrachian; of Insects, seventeen lepidopters; of Mollusca, three Bulimi.

The Amazons, the Rio Negro and the Madeira divide the great plain into four districts, apparently similar in vegetation, climate, etc. Yet these rivers act as barriers to several species, and native hunters, understanding the fact, cross the river to procure certain animals. Five species of monkeys are confined to the north bank of the Amazons, and two to the south side. The blue macaw, green jacamar and curl-crested toucan never cross the Great River, though butterflies are known to fly over it. What is the cause of this isolation? Not the forest, for there is not a single tree which is not found both on the northern and southern banks.—Prof. JAMES ORTON.*

ABSENCE OF EYES IN CLASSIFICATION.—Dr. Hagen's objection to the generic estimation of the lack of visual organs in the cave crustaceans is even less weighty than I had supposed; viz., the fact that in certain cave insects, the female sex only is deprived of eyes, the males possessing them. No one knows better than Dr. Hagen, that in many genera and even families and higher groups of insects the definitive characters are only to be found in the male sex; and I believe that in some crustaceans it is the female which exhibits the greatest departure from the embryonic starting point. In each case the most extensively developed sex must of necessity furnish the characters which determine the status of the species. But it is unnecessary to refer to special cases of this kind, for as I have already shown, the developmental status of the eyes in the blind catfish is very variable in both sexes and opposite sides of the head. This would have been a far better reason for rejecting the recognition of this character as generic. But on

* Abstract of a paper read at the American Assoc. Adv. of Sci., 1872.

the same grounds we must reject *all* characters now regarded as generic, for there is scarcely one which cannot be found to be variable in some species in some more or less remote region of the animal kingdom, recent or extinct. Hence, as I have often urged, it is the *constancy* of a character in the group of species where it exists that determines its value. This is the philosophy of universal custom. The same remarks may apply to my *Orconectes inermis.* Though I could not make it agree with Dr. Hagen's second form of *O. pellucidus*, it may be such, as Dr. Hagen's knowledge of these animals is much greater than mine, and I would at once accept his determination in the case. But what are these "forms"? If inconstant they are only varieties; if constant, species.—EDWARD D. COPE.

VITALITY AND SEX.—Prof. Riley mentioned at the meeting of the American Association a few interesting entomological facts in support of Dr. Hartshorne's paper, and to show that in some way or other the male element is connected with defective vitality. In studying *Phylloxera vastatrix*, or the grape-root louse, he had always found the male pupæ most abundant on such roots as had been most depleted and where the insects were already beginning to die off for want of sufficient nutrition.

In the common oyster-shell bark-louse of the apple tree (*Mytilaspis conchiformis*), which had been increasing and spreading for many years past in the northwestern states, something similar occurred. The male of this species had been sought in vain for a quarter of a century both by entomologists and horticulturists; and they were forced to the conclusion that the species multiplied agamically and despaired of ever finding the male. But for the past three or four years this insect has been rapidly dying out in those sections where it once flourished, until at last it is no longer dreaded by the orchardist. Under these conditions of lessened vitality the male element suddenly appears, and Mr. Riley had the satisfaction of discovering it the present summer.

"SPIKE-HORNED MULEDEER."—In the July number of the NATURALIST, Prof. E. D. Cope refers to a supposed specimen of a spike-horned muledeer (*Cervus macrotis*) obtained in Kansas. Without questioning the probable occurrence of "spike-horns" in *C. macrotis*, the size of the horns mentioned by Prof. Cope seems to render the reference of the specimen in question to *C. macrotis* somewhat

open to doubt. The length of the spike in this case is said to be two feet and a half, which is enormous when it is considered that the fully developed antlers of old bucks of this species rarely much exceed two feet, measured along the curvature of the beam to the end of the longest point. On the other hand, it is just such a spike as is usually developed in a two-year old buck elk (*C. Canadensis*), an animal also common in Kansas along the Kansas Pacific Railway.

The occurrence of spike-horned bucks in *C. Virginianus*, which has of late attracted so much attention, seems in no way remarkable. Prof. Baird, in writing of the *C. Virginianus* in 1857, says, "Sometimes a perfectly adult, full-grown male will have but a single slender spike, thus resembling the buck of the second year." (Mam. N. Amer., p. 647.)—J. A. A.

Since the above was written I have learned from Prof. Cope that he at first also regarded the horns as those of a two-year old elk, and only referred them to *C. macrotis* on being assured that the elk did not occur at the locality (Fort Hays, Kansas) where these horns were obtained. From personal knowledge, however, I am able to affirm that the elk is of quite common occurrence within a few miles of Fort Hays.—J. A. A.

The Rattle of the Rattlesnake.—At a meeting of the Essex Institute in May last Mr. F. W. Putnam gave a description of the structure of the horny appendage to the tail of many snakes, especially developed in the genus of Rattlesnakes, and controverted the idea of natural selection having anything to do with its peculiar development. He also thought that the supposition that the rattle was a benefit to the snake, as a means of enticing birds, by its sound imitating that made by the Cicada, as suggested by a writer in a late number of the Naturalist, could not be accepted. The Cicada, during the few weeks that it existed in the adult state, at which time the males made their peculiar drumming, was not a ground insect, and was not very abundant, even among the trees, in such localities as were most frequented by the rattlesnake. Secondly, the sound made by the snake was very slight under ordinary circumstances, and the rattle was not sounded to any extent unless the snake was disturbed by some cause. His own observations on these snakes, in their natural habitat, led him to believe that it was not at all their nature to

set up a rattling for the sake of enticing birds to them, but that they would slowly and cautiously approach their victim, or else lie in wait ready to give the fatal spring upon anything that came near. He believed that the rattle was in reality a detriment to the snake, except in so far as it served to call the sexes together, which he thought was most likely its true function.

FLIES AS A MEANS OF COMMUNICATING CONTAGIOUS DISEASES.—Prof. Leidy remarked at a late meeting of the Academy of Natural Sciences of Philadelphia, that at this time, during the prevalence of small pox, he was reminded of an opinion he had entertained that flies were probably a means of communicating contagious disease to a greater degree than was generally suspected. From what he had observed in one of the large military hospitals, in which hospital gangrene had existed, during the late rebellion, he thought flies should be carefully excluded from wounds. Recently he noticed some flies greedily sipping the diffluent matter of some fungi of the *Phallus impudicus*. He caught several and found that on holding them by the wings they would exude two or three drops of liquid from the proboscis, which, examined by the microscope were found to swarm with the spores of the fungus. The stomach was likewise filled with the same liquid, swarming with spores.

GEOLOGY.

EXTINCTION OF BIRDS IN MAURITIUS, ETC.—I believe I have demonstrated, by the examination of the bones which have been found in the recent deposits in the Mascarene Islands, and which belong, for the most part, to extinct species, such as the dodo, the solitaire, the aphanapterex (*Fulica Newtoni*), large parrots, etc., that these islands have once been part of a vast extent of land, that these lands, by little and little and by a slow depression, have been hidden under the waters of the ocean, only leaving visible some of their highest points, such as the islands of Mauritius, Rodriguez, and Bourbon. These islands have served as a refuge for the last representatives of the terrestrial population of these ancient epochs; but the species, confined in too limited a space and exposed to all causes of destruction, have disappeared by degrees; and man has in some measure aided in their extinction.

Madagascar evidently was not in communication with these islands; for when Europeans visited them for the first time, they

did not find there any Mammalia, with the exception of some large bats; none of those remarkable Lemuridæ peculiar to the fauna of Madagascar existed in the Mascarene Islands. The study of fossil birds leads to the same result; and three species of Æpyornis which Mr. A. Grandidier and I have been able to recognize among the fossils collected in the swamps of the south-west coast haye enabled us to establish the relationship which connects these birds with the Dinornis, the Palypteryx and Aptornis of New Zealand. All these species belong to the same zoological type, and make us feel that at a more or less remote epoch there may have existed some communication between these lands so far away from one another; perhaps groups of islands, now submerged, formed intermediate stations, of which unfortunately we have no trace.—A. MILNE-EDWARDS, *from American Journal of Science and Arts.*

THE EOCENE GENUS SYNOPLOTHERIUM.—This genus rests on a single species of about the size of a black bear, from the southern Wyoming Eocene. Many parts of the skeleton are preserved, and furnish the following characters. The toes of the fore foot are four, the outer materially shorter than the others; the claws flat, ovate, and deeply fissured above; the tail slender; the head with a flat muzzle with anterior nareal exposure and premaxillary bones much contracted below, and with a wide lateral vertical groove. Immediately behind this projects a huge canine tooth, and the outer face of the outer incisor is exposed in its bottom. There are three upper incisors, the median two much smaller than the external, which is as large as many canines. The mandible had six molars, the last shorter than the penultimate. They are separated by a toothless interval from the incisors, which are very large and directed upwards and forwards like those of a rodent. They oppose the outer incisors at the extremity, and the canine superiorly and laterally, performing thus a double service.

This form is evidently allied to the genera Anchippodus of Leidy and Psemotomus Cope, as well as to the larger Loxolophodonts and are either forms of Proboscidia or represent those connecting this group with the Perissodactyla. They are thus of interest, and their full analysis cannot fail to be of value to zoology —EDWARD D. COPE,* A.M.

* Read at the Dubuque Meeting of the American Association for the Advancement of Science, Aug., 1872.

Glacial Action in Fuegia and Patagonia.—Professor Agassiz of the Hassler Expedition, as we find in the "American Journal of Science and Arts," gives an interesting account of land ice action in these countries, describing rounded and polished rocks, boulders, and glacial scratches. Prof. Agassiz concludes from the character of the north and south sides of the summits in Fuegia, and from other facts, that the movement of the ice was towards the north, and independent mainly of the present slopes of the land. The region over which he states that he observed glacial phenomena in southern South America includes all of the continent south of 37° of south latitude both on the Atlantic side (Bay of St. Matthias) and the Pacific side.

New Land Shells from the Coal Measures.—Prof. F. H. Bradley describes and figures in the August number of the "American Journal of Science and Arts" two new land shells from the coal formation of Illinois. It will be remembered that Dr. Dawson found many years since a pupa (*P. vetusta*) in the same formation in Nova Scotia. The new pupa is called *Pupa Vermilionensis*. The other shell, referred by Messrs. Meek and Worthen to a marine family (Rotellidæ), Mr. Bradley considers as a helicid, and describes it under the name of *Anomphalus Meekii*.

ANTHROPOLOGY.

A Remarkable Indian Relic.—Having a few days of leisure, I started on Monday last, in company with my friend, J. F. Bly, Esq., to visit the fish-breeding establishment of Jazael Robinson at Meredith Village, N. H., hoping to make some pleasant additions to my rather limited knowledge of Natural History, to refresh the memories of beautiful scenery about the lake, and breathe again the air of the mountains.

The process of fish breeding and raising was elucidated by our guide with so fascinating an interest that we ceased to wonder at the prevalence of "fish fever." Some five thousand trout in the lower pond were a foot or more in length and ravenous for something to bite. A finger held within an inch of the surface was sure to be jumped at and seized — as was a gentleman's nose which happened incautiously to be held too near the water.

On returning to the village we inquired for any object of scientific interest which might be worth seeing, and were told at once of

a wonderful sculptured stone which had been found the week before by some workmen of Mr. Seneca A. Ladd. As Mr. Ladd is quite a naturalist, and has already an extensive private collection of relics and specimens, he was delighted with the new discovery, and exhibited and explained the really remarkable relic with an enthusiasm which only the genuine student can feel.

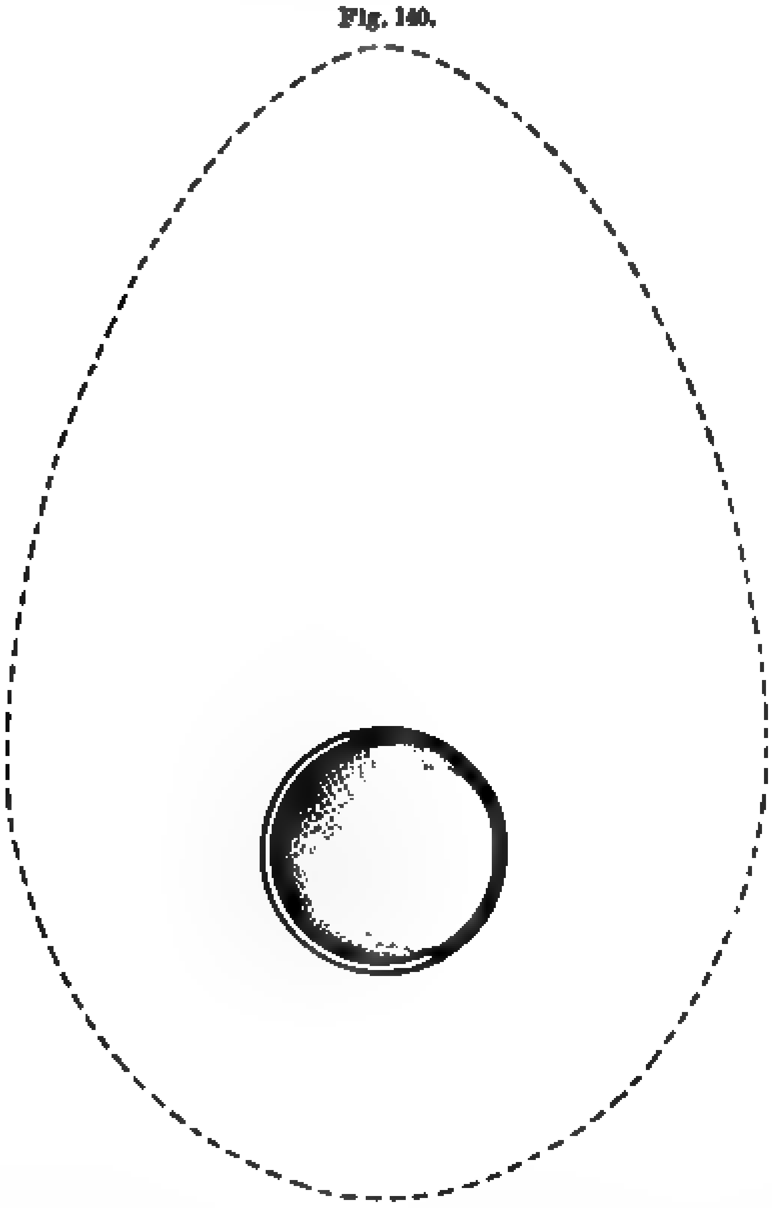
The stone was found at a depth of about two feet, in the sandy

Fig. 139.

drift at the head of the lake, where the ground apparently had not been disturbed for centuries. The location is at the point where Lake Waukewan ("Measly Pond") originally emptied into Lake Winnipiseogee, and was, no doubt, a favorite fishing ground for the primitive tribes that formerly inhabited that region. The water has been diverted from this channel, and now flows through a canal furnishing the remarkable water power of forty feet per-

pendicular fall, which carries on the hosiery and other manufactories here. About the first of June Mr. Ladd was causing the digging of post holes for a fence, when one of the laborers threw out what was apparently a lump of clay some six inches in thickness. The occurrence of such a body in this soil attracted Mr. Ladd's attention, and a slight examination revealed a section of the stone. After a careful cleaning process, with water and

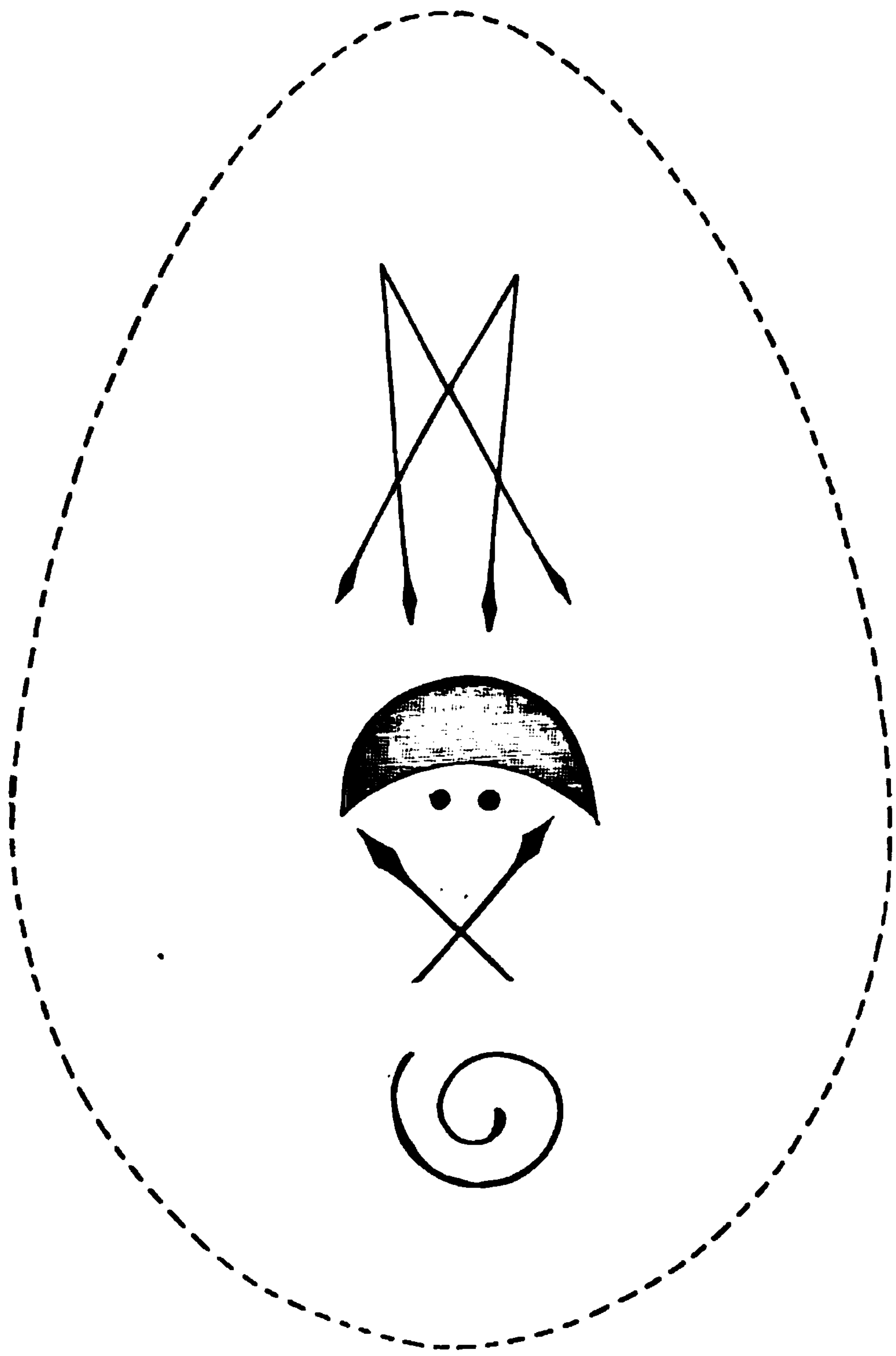
Fig. 140.



brushes, the coating of clay was removed and he was delighted to find himself in possession of as interesting an archæological relic as yet found in New England. It is not to be wondered at that he takes pride in showing it, and preserves it with the greatest care. We were kindly allowed to make sketches of it, and have had the illustrations engraved to which we shall refer.

The stone is of an oval form, smoothly finished upon the surface, and of as perfect contour as if turned in a lathe. Its dimensions are $3\frac{7}{8}$ inches in length and $2\frac{3}{8}$ inches in thickness. The material is a silicious sandstone of a greenish clay-drab color and of fine grain. The sculptures are mostly in bas-relief, upon a ground sunk below the surface of the stone and of a higher grade of art than usual in Indian workmanship. It is difficult to con-

Fig. 141.

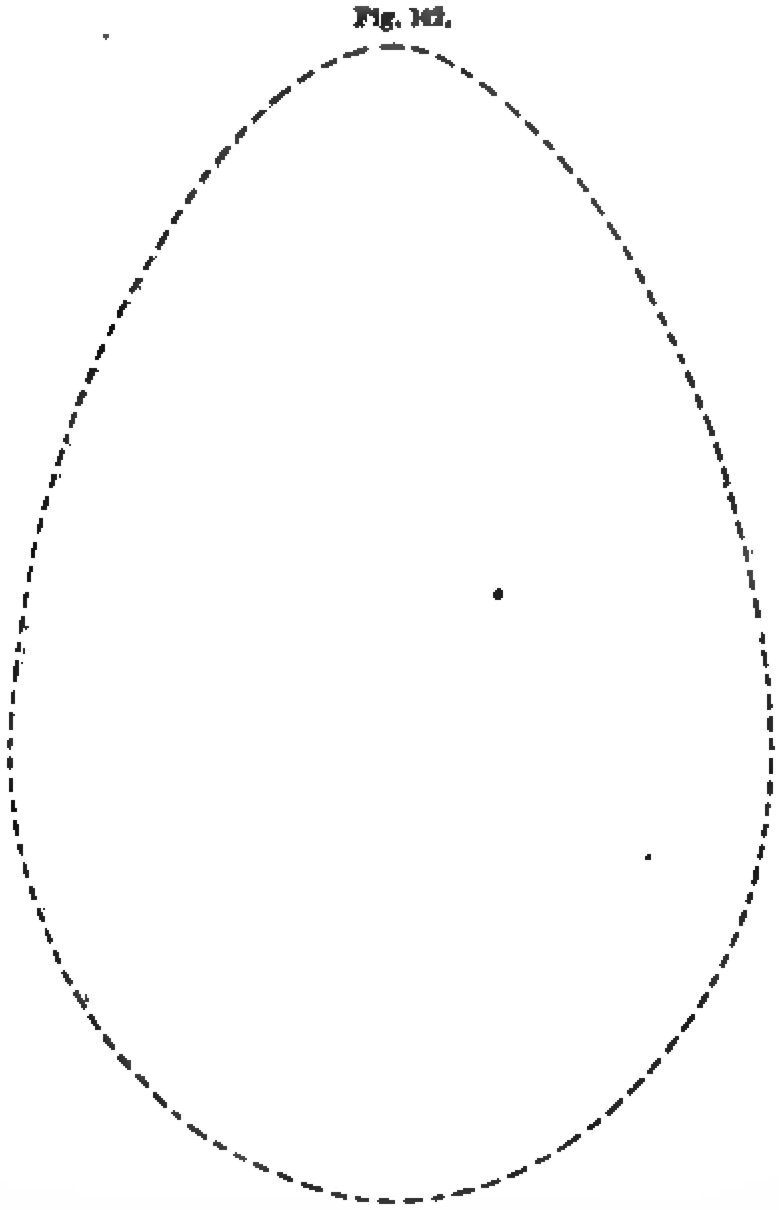


ceive that such work could be done without the aid of metal tools. A hole was drilled through the longest diameter which tapered uniformly from $\frac{3}{8}$ of an inch at the larger end to $\frac{1}{8}$ at the smaller, the use of which was probably the same as in the class of stones known as "gorgets," to which we should refer it. Around the aperture at each end was a border of points like a star, as will be seen by figure 139.

Figure 139 is intended to give an idea of the form of the stone, the figures at the sides being the profiles of Figs. 140 and 142. The Indian 'mask' has the characteristic outline and projecting mouth seen in other specimens of Indian art. The wavy lines on the forehead are supposed to indicate the hair. The finish of the whole is quite elaborate.

In figure 140 the dotted line is intended to indicate the position

Fig. 142.



of the picture on the stone. The lines of the 'wigwam' are regularly drawn, and the surface is "pricked up" or roughened. The circle below is perfectly rounded and supposed to represent the full moon, although every one has the privilege of forming his own theories in regard to the significance of the symbols.

Figure 141 has a delineation of four 'arrows' inverted. Underneath this is a 'new moon,' and two round dots that may repre-

sent 'stars.' Below this are two 'arrows' crossed and a convolute or coil which may be a 'serpent.'

Fig. 142 shows an 'ear of corn,' nicely cut, and in a depressed circle are three figures, the central one representing a 'deer's leg,' and the others of doubtful interpretation.

As an illustration of the surmises of those who are interested in deciphering such inscriptions we give the following, which is certainly ingenious and even plausible.

It is suggested that the stone commemorates a treaty between two tribes. The reversed arrows in Fig. 141 symbolize peace; the moon and stars the date; the crossed arrows a union of the two forces for aggressive or defensive purposes, etc. The wigwam might indicate the place where the treaty was consummated, and the corn and other emblems the feast by which it was commemorated.

It is to be hoped that the stone, or, at least, casts and photographs of it, may find their way into our collection at Salem. — D. J. Tapley.

The Boomerang.—The earliest inhabitants of the globe as they spread themselves over the earth, would carry with them the rudiments of culture which they possessed, and we should naturally expect to find that the most primitive arts were, in the first instance, the most widely disseminated. Amongst the primæval weapons of the Australians I have traced the boomerang, and the rudimentary parrying shield—which latter is especially a primitive implement—to the Dravidian races of the Indian peninsula and to the ancient Egyptians, and although this is not a circumstance to be relied upon by itself, it is worthy of careful attention in connection with the circumstance that these races have all been traced by Prof. Huxley to the Australoid stock, and that a connection between the Australian and Dravidian languages has been stated to exist by Mr. Morris, the Rev. R. Caldwell, Dr. Bleek, and others.* And here I must ask for one moment to repeat the reply which I have elsewhere given to the objection which has been made to my including these weapons under the same class, "that the Dravidian boomerang does not return like the Australian weapon." The return flight is not a matter of such primary importance as to constitute a generic difference, if I may use the expression, the utility of the return flight has been greatly exaggerated; it is

* Journal of the Anthropological Institute, No. 1, vol. i, July 1871.

owing simply to the comparative thinness and lightness of the Australian weapon. All who have witnessed its employment by the natives, concur in saying that it has a random range in its return flight. Any one who will take the trouble to practise with the different forms of this weapon, will perceive that the essential principle of the boomerang, call it by whatever name you please, consists in its bent and flat form, by means of which it can be thrown with a rotatory movement, thereby increasing the *range and flatness of the trajectory*. I have practised with the boomerangs of different nations. I made a *fac simile* of the Egyptian boomerang in the British Museum, and practised with it for some time upon Wormwood Scrubs, and I found that in time I could increase the range from fifty to one hundred paces, which is much farther than I could throw an ordinary stick of the same size with accuracy. I also succeeded in at last obtaining as light return of flight; in fact it flies better than many Australian boomerangs, for they vary considerably in size, weight and form, and many will not return when thrown. The efficacy of the boomerang consists entirely in the *rotation*, by means of which it sails up to a bird upon the wing and knocks it down with its rotating arms; very few of them have any twist in their construction. The stories about hitting an object with accuracy behind the thrower are nursery tales; but a boomerang, when thrown over a river or swamp will return and be saved. . . . . To deny the affinity of the Australian and Dravidian or Egyptian boomerang on account of the absence of a return flight would be the same as denying the affinity of two languages whose grammatical construction was the same because of their differing materially in their vocabularies. —*From the Address of Col. Fox before the Anthropological Section of the British Assoc. Adv. Sci., Aug.*, 1872, *in* "*Nature.*"

Antiquity of Man in France.—The International Congress of Anthropology and prehistoric Archæology held its sixth meeting at Brussels in August last. The editor of "La Revue Scientifique" thus notices what had been done in France and Belgium to establish the high antiquity of man. "Indeed, if in France there was announced for the first time in 1829, by three southern geologists, De Christol, Tournal and Emilieu Dumas, the astounding proposition that man was living at the same time as the great animals of lost species whose bones fill the soil of caverns; if it

is to the indomitable perseverance of a French savant, Boucher de Perthes, that we have seen this proposition become established in science; if it is to the regretted Thompsen and other savants of Scandinavia that we owe the first attempts of a classification of these times forgotten by history; it is a Belgian, Schmerling, who has definitely demonstrated, and placed beyond controversy, the proposition of our geologists of central France. In 1834 he showed that in the caverns of the province of Liége there existed some very ancient land slides which had recovered some palæontological beds with human bones, these having been thus removed from all subsequent handling, so as to place the contemporaneity of the débris they contained beyond all doubt.

MICROSCOPY.

Classification of Microscopic Objects.— Dr. James Murie, of Middlesex Hospital, England, has contributed two elaborate papers on this subject to the Royal Microscopical Society.

In the arrangement of objects in a microscopical cabinet he adopts the following excellent rules, which are equally applicable to any system of classification. 1. Do not needlessly multiply similar specimens. 2. Do not, on feeble grounds, separate naturally allied objects. 3. Maintain, as far as possible, a uniform style of nomenclature and size of slide. 4. Endeavor to place in the cabinet good typical specimens well prepared. 5. Reject all lumber, which only weakens a collection.

In arranging objects belonging to the organized kingdoms, it is customary to begin with a series of elementary tissues, either preceding the main collection with this, or developing it from this. Thus advise the writers on histology, and thus are arranged the great histological collections. Such a classification, which may be advisable in collections (as in books) used for teaching the elements of histology, and in small private collections where little more than types of the different kinds of cells are present, is unnecessary in large collections designed for consultation and reference by those who are somewhat familiar with the primary elements, and undesirable from causing an unnecessary duplication of specimens and from marring the general harmony and sequence of the grouping. The elementary tissues can generally be conveniently arranged along with the organs they help to build up; or, at most,

each natural kingdom may be preceded by a few typical slides illustrating, not exhaustively, the material of which it is built.

In the mineral kingdom, micro-chemicals precede micro-minerals, but there seems to be no gradation of minute forms upon which a classification could rest. The systems employed in the text-books may therefore be followed. Polarizing objects form a convenient subsection. Several specimens of the same substance may be arranged geographically. There should be no microscopical geology, but its subjects should be scattered through the general collection according to their biological relationships. To every natural division should be appended a series illustrating its application to the arts and manufactures, showing its utility, purity, adulterations, etc.

In the vegetable kingdom the natural orders should, as far as possible, regulate the general arrangement, while the subsidiary divisions should be of a physiological character. Often the lower organisms can be viewed in their completeness in a single slide, while the higher can only be illustrated by a succession of subseries. The lower forms, almost up to the ferns, should be primarily grouped according to their genetic affinities, the subdivisions being physiological. The higher forms, however, monocotyledons and dicotyledons, should be primarily divided physiologically, according to organs and apparatus, the secondary divisions being dependent on genera, families, etc. Thus the roots, stems, flowers, etc., must be grouped together and not separated that each genus may be separately illustrated. Fossil forms should be placed with the rest. Specimens of unknown affinities may be arranged geologically, geographically or according to their economic value. Teratology should follow physiology. Fabrics, adulterations, etc., should conclude the series.

The animal kingdom should be arranged on the same general principles as the vegetable kingdom.

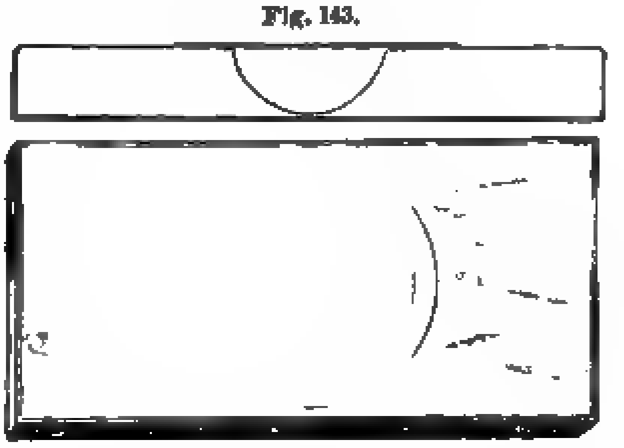
The cabinets for the retention of objects are best made small and in a cubical form so that any number of them may be piled up to form a large cabinet. The slides should lie flat in drawers containing but a single layer. Some of the English opticians sell cabinets of polished deal, which are a cheap and excellent substi tute for the elegant mahogany cabinets ordinarily used. When greater cheapness is required, trays of tin or of pasteboard may be used, piled up in boxes of convenient size according to the plans

of Mr. Henry George and Mr. Piper. The cabinet may be furnished, at the bottom, with some deep drawers for the reception of large objects in deep cells; the heavy objects thus brought together being represented in the classified collection by blank slides properly numbered and labelled, and referring to the drawer in which the object is to be found. Slides not exceeding three inches square are easily arranged in the regular drawers, and if any exceed three inches they should still be placed in their proper position, the partitions being cut away so as to allow them to occupy a double interspace.

A Life Slide.—The accompanying engravings represent front and side views of a form of life slide for the microscope, designed and used with much success by Mr. D. S. Holman. It is constructed to retain the greatest quantity of material under the smallest cover glass, and is designed to be used with the highest powers of the microscope for studying the Bacteria, Vibriones, and other very low forms of life.

The slide consists, as will be seen from the cuts, of a central polished cavity, about which is a similarly polished bevel; and from the bevel outwards extends a small cut, the object of which is to afford an abundance of fresh air to the living beings within, as well as to relieve the pressure, which shortly would become so great, from the evaporation of the liquid within, as to cause the destruction of the cover glass.

Fig. 143.



No special dimensions are stated for the central cavity. The bevel is usually $\frac{1}{8}$ inch in diameter (the cut is $\frac{2}{3}$ of natural size); the small canal is cut through the inner edge of the bevel or annular space, outwards, for the purpose named above.

It is found, upon enclosing the animalculæ, etc., that they will invariably seek the edge of the pool in which they are confined, and the bevelled edge permits the observer to take advantage of this disposition; for when beneath it, the objects are within range of the glasses of high power.

Another very important feature in the device is the fact that a

preparation may be kept within it, for days or weeks together, without losing vitality, owing to the simple arrangement for supplying fresh air.

We have repeatedly had the opportunity of witnessing the use of this slide, and are convinced that nothing of the kind has yet been devised which can equal it in excellence, either for observing or generating the lower forms of life.—*Journal Franklin Institute.*

To Blacken Brass.—The following methods are given by anonymous correspondents in the "English Mechanic and World of Science." Though not new they will be useful to readers, who desire to give a dead-black finish to adapters, diaphragms, etc. Warm the brass over a gas flame or spirit lamp, and plunge it while hot for two or three seconds into nitric acid. Then heat again until it blackens, brush off the blisters, and lacquer if a lustrous surface is desired. Instead of the nitric acid the following fluid may be used: a mixture of two parts of arsenious acid, four parts of hydrochloric acid, one part of sulphuric acid, and eighty parts of water.

Monochromatic Sunlight, by Means of Glass Plates.—Mr. J. Edwards Smith, of Ashtabula, Ohio, has obtained light with which he is perfectly satisfied by means of a light sky-blue and darker green glasses. He prefers to use one blue glass combined with two or three green ones, the best shades being ascertained by trial. Several such sets, of different depths of color, may be mounted in a series, like magic lantern pictures, so that either set can be brought easily over the hole in the shutter. By sunlight transmitted through such a combination of glasses, and without condenser or apparatus of any other kind, he "resolves" all the shells of the Probe Platte with perfect ease. He considers the light thus modified as good as the more nearly monochromatic light of the troublesome ammonio-sulphate cell.

An Optical Experiment.—A correspondent of the "Scientific American" thinks the photographic camera might be a means of gaining an unlimited magnifying power. He would photograph an object and then take a series of enlarged views, each one representing on an enlarged scale, a portion of the preceding one. Evidently he is not accustomed to the use of magnifying powers.

Camphor in Paraffin Lamps.—Mr. John A. Perry, of Liver-

pool, calls attention to the fact that about fifteen grains of camphor added to the paraffin in an ordinary sized lamp about an hour before using, will greatly increase the brilliancy of the light.

Mounting Small Objects in Balsam.—A correspondent in the "English Mechanic and World of Science," who has been troubled by the balsam washing away from the centre of the slide small objects, such as starch grains and diatoms, advises that the balsam be placed on the slide in the form of a ring around the object, so as to run in upon it from all sides and not drift it away. A better contrivance is to wet the object and allow it to dry upon the slide, after which it will not easily be misplaced. A trace of gum arabic may be added to the water if, as will seldom be the case, it should be found necessary.

Bone Dust in Soap.—If any kind of soap seems irritating to the skin, particularly the cheaper kinds of "Old Brown Windsor," try the microscope for the detection of fine particles of ground bone which have not been separated from the fat of which the soap was made.

The Fresh Water Polype.—Mr. James Fullagar gossips pleasantly about the *Hydra vulgaris* in "Science Gossip." He has no difficulty in multiplying his specimens by cutting up the animals; though the parts do not lead an equally favored life, for the head-part proceeds to eat immediately, while the stalk is obliged to wait patiently several hours, fasting, until a new head and tentacles are developed. The polypes contracted and dissolved into a confused mass of granules in December. None could be found during the winter, but very small ones appeared in the spring, and still later these assumed a large size and began to multiply by budding. The earliest that appeared, much smaller than those produced by budding, he believed to be produced from eggs, though their origin escaped him, as it had escaped previous observers.

Reproduction of Sponges.—In a memoir on two New Sponges, etc., in the Annals and Mag. of Nat. Hist., Mr. H. J. Carter remarks that he last year confirmed Prof. H. James Clark's discovery of a "collar" round the cilium of the sponge animal, which must now be regarded as the animal of the sponge, as much as the polype is regarded as the animal of the coral.

The animalcule of the sponges is described, in its passive form, as "a minute globular cell, apparently filled with granuliferous plasma, bearing a nucleus and two contracting vesicles, provided with a rostrum or projecting cylindrical portion supporting a delicate fimbriated collar, in the midst of which is a single cilium, and, in its active state, will take into its body crude material (that is, particles of indigo) if they be presented to it. The collar and rostrum possess the power of polymorphism; and, when necessary, the whole body can be thus transformed. The latter is about $\frac{1}{3000}$ inch in diameter in the calcareous sponges, and only half that size in those of the siliceous ones that I have examined; and they are arranged in countless groups on the living sarcode of the areolar cavities of the sponge." Of other familiar animalcules this resembles most the Difflugia, a kind of Amæba which throws out its pseudopodia from one particular part of its globular form; and if the zygosis among the Difflugiæ is a true conjugation, there is strong reason for believing any similar union of the sponge animalcules to be of the same nature. Though the author does not positively assert that the zygosis of the Difflugiæ is a means of reproduction, he seems inclined to that belief, partly because that procedure is always confined within the limits of species; and he seems to have traced a corresponding link in the history of the sponges.

Finally, the author, having noticed a tendency to speak more decidedly in microscopical inquiries than our powers seem to him to justify, condemns as unphilosophic the usage of those who call the parts of the lower organisms structureless. A wall or layer may be so dense and conspicuous as to be readily observed and named, yet it would be unphilosophic to call it wanting if only infinitely delicate and therefore imperceptible. The leg of Euplotes is "probably" complicated in its muscular structure, and there are textures in the Spongiadæ, he doubts not, which are distant and misty hints of development, which in the higher animals are recognized by the coarsest sense.

MULTIPLICATION OF WHEEL ANIMALCULES BY BUDDING.—Dr. R. Greef has no difficulty in confirming the asexual reproduction of the Vorticellæ by fission, but reaches a very different conclusion in regard to the formation of the budlike structures which he finds are not buds at all, products of their bearer, but the products of

several times repeated fission of other individuals, which attach themselves from without and thus become united to the larger individuals. Stein has already traced this remarkable process and named it gemmiform conjugation. A full discussion of this process is given in the "Annals and Mag. of Nat. Hist." for June, 1872.

Spicules of Sponges. — Dr. J. E. Gray, in treating of the Classification of Sponges, in the "Annals and Mag. of Nat. Hist.," remarks that the order Coralliospongia presents the greatest abundance and the most diversified forms of spicules. The spicules that form the greater part of the skeleton of these sponges are generally joined together by a siliceous substance. Dr. Bowerbank has repeatedly denied this explanation, and calls them siliceo-fibrous sponges; but the perfect form of the spicules and the thin layered additional siliceous deposit which unites them can be well seen in a section, or in a portion of the skeleton disintegrated by the heat of a spirit lamp.

Some sponges have a fashion of collecting and imbedding in their sarcode spicules which are the remains of other sponges; and therefore care is necessary to determine which spicules really belong to the organism in which they are found. Some species even exercise a selection of certain kinds of spicules for this singular kind of absorption.

Though the form and arrangement of the spicules afford important means of classifying the sponges, the external form is an equally important character which cannot be disparaged, as has been done by some distinguished observers. It is true that some of the species are very polymorphous; but the same is true of some algæ and zoophytes which are still classified with some reference to their general forms.

NOTES.

The twin peaks, known as Torrey and Gray's Peaks, the highest of the Rocky Mountains, so far as yet ascertained (being considerably over 14000 feet), were last summer visited by the discoverer, Dr. C. C. Parry, who first ascended and named them in the year 1862, and by the two botanists whose names he gave to them. A full account of the ascent of Gray's Peak, on the 14th of August last, by Dr. Parry, Dr. Gray, and numerous citizens of Georgetown,

with other travellers, was published in the "Colorado Miner," edited by the Rev. Professor Weiser, who made an encomiastic address upon the occasion, upon the mountain's summit. The visit of Dr. Torrey was a few weeks later. Gray's Peak being the easier to surmount, is ascended almost every fine summer day from Georgetown; and when a better bridle-road replaces the present rude trail of the last two miles the whole ascent may be made with wonderfully little toil. As Gray's Peak is the one commonly visited, and as it has never received any other name, it has come to have more celebrity than its equally picturesque and perhaps rather loftier fellow, and sometimes the name is applied in the plural number to both culminations, or else the name of Irwin's Peak is used to designate the western one. But it is understood that Mr. Irwin's exploration of this peak was a few years later than Dr. Parry's ascent of both and his dedication of them, one to his botanical master, and the other to Dr. Torrey's associate in publication, Dr. Gray. The citizens of Georgetown, as represented by a numerous deputation, assembled upon this twin mountain upon the occasion referred to, and took the opportunity to do an act of justice, no less than of well deserved compliment, by formally resolving that the original name of the western peak, as assigned by Dr. Parry, ought to be and should be restored: that, as the one is everywhere known as Gray's, the other should in the future, as at first, be known as Torrey's Peak, and so our botanical Nestor be no longer defrauded of the honor which was specially intended for him in the original naming. We wish it could be added that Dr. Torrey had accomplished the ascent of his own beautiful mountain upon the occasion of his recent visit; but unpropitious weather prevented his reaching the summit.

An incomparable distant view of these peaks is to be had from the summit of Mount Parry, which rises between the valley in which Empire City lies and the Middle Park.—A. G.

We regret to announce the death of Professor John B. Perry, which took place at his home in Cambridge, on the third of October, in his forty-sixth year.

Professor Agassiz's stay on the Pacific coast is having good results in awakening an interest in natural science among the people. We notice by the "Sacramento Daily Union" of Oct. 5, which contains a very full report of a lecture by Prof. Agassiz,

and an account of a reception given to him, that steps were taken to organize at once a Natural History Society in Sacramento by Dr. Logan and others.

AMONG the recent improvements in our colleges for enlarged facilities in science-teaching may be mentioned the new laboratory erected at Colby University, Waterville, Maine, at an expense of $30,000. It is 48 by 56 feet long, and two stories in height. The lower story will be devoted to chemistry, the upper to a museum of Natural History. Provision has been also made to establish a chair of Natural History and Astronomy.

AT Bowdoin College also, Hon. P. W. Chandler is to refit Massachusetts Hall as a Natural History Museum, in memory of the late Professor Cleaveland, at an expense of $8,000 to $10,000, the work being partly done. It is hoped that the graduates will take a pride in sending rare specimens of animals, plants and fossils to fill up existing vacancies.

WE have received the first number of a new monthly bee journal, "The North American Bee Journal" published by Moore and King, Indianapolis, Indiana. Its appearance indicates the popularity of bee keeping, and while Wagner's "American Bee Journal," published at Washington, is by far the most scientific and ably conducted that we have seen, there is undoubtedly room for more. By the way, when shall we have observations made in this country on the development and mode of growth and habits of the honey bee comparable with those of the best German apiarists? Is it not time for the appearance of an American Dzierzon and Siebold, or must we wait another century? Cannot science and practice among apiarians be united in America as well as in Germany?

A regular meeting of the California Academy of Sciences was held Monday, August 6th. Many valuable specimens of aboriginal skulls, minerals, petrifactions from near Salt Lake City were presented to the Academy.

Mr. Stearns called the attention of the Academy to the death of Major S. S. Lyon of Jeffersonville, Indiana, and referred to the ability and distinguished services of the deceased.

Dr. Blake exhibited a specimen of an apricot which was spotted upon the surface with a blight probably the same which attacks the grape, and further remarked that the peaches and nectarines

this year, particularly in the valley of the Sacramento, appeared to be quite generally affected by it.

Mr. Stearns submitted specimens and a description of a new species of Truncatella, which he had named *T. Stimpsonii;* it differs from the only other species of Truncatella credited to the Californian province in having longitudinal ribs, the other species being smooth.

Dr. Gibbons announced the expected arrival within a few days of Dr. John Torrey and Prof. L. Stone, the latter visiting the coast for the purpose of investigating the salmon in connection with the introduction of the best variety in the rivers of the Eastern States.

The French Association for the Advancement of Science held its first session at Bordeaux, in September, about eight hundred members being present. The association is divided into fifteen sections. Many papers were read and various excursions were made in the vicinity.

The British Association met at Bristol, in August, and though upwards of two thousand members were present, and a goodly number of papers were read, yet there seems to have been some special cause that has led the press to consider the meeting as not so successful as some others. The address of Dr. Carpenter on "Man as the Interpreter of Nature" and Sir John Lubbock's address on the " Origin of Insects," (not yet published) were perhaps the most noteworthy productions of the session.

The Swiss Association of Naturalists (Société helvétique des Sciences) assembled this year at Fribourg, on the 19th, 20th and 21st of August, and met with a hospitable reception from the inhabitants and authorities of the little city. There is no place of half its size in the Confederation but has greater cause to boast the number of its scientific students and yet nothing was left undone to make the meeting successful. On the evening of the 18th most of the visitors had arrived and greeted each other informally in the Tivoli gardens, a public resort just outside the city. The regular proceedings opened the following morning at ten o'clock, when the President, Dr. Thurler of Fribourg,* welcomed the association in a few words, recounted the part Fribourg had played

* The President is apparently selected from the town where the meeting is held.

in the history of Swiss science and drew attention to its public works of scientific interest.

As an appropriate introduction to the scientific communications, Prof. Gilliéron of Basle gave an account of the Fribourg Alps, lying in four concentric arcs between the lakes of Thun and Geneva. He passed in review the successive deposits and gave an admirable sketch, rapid, clear and concise, of their relations to one another, dwelling with especial force on some points of local interest.

Dr. Gros then exhibited a collection of objects of considerable importance belonging to the bronze and stone ages obtained from Locraz, Lake of Bienne, during a recent partial draining of the lake.

M. Favre read a report of progress made in the preservation of the large erratic blocks of Switzerland. The cantonal government assume the protection of these, according as they are recommended by a standing committee of the association.*

The session closed with an account by Dr. de Saussure, of the last eruption of Vesuvius and the consequent changes in the physiognomy of the mountain, illustrated by a map and specimens obtained on a recent visit.

The following day was devoted to sectional meetings, which opened at the early hour of eight. Dr. de Saussure presided over the zoological section, where the first communication was made by Prof. Vogt; he gave a detailed account, accompanied by numerous enlarged sketches, of the transformations of Artemia; special attention was drawn to the fact that in the young, the second pair of articulated members are natatory legs, similar in both sexes, which afterwards become complicated and enormously developed claspers in the male, and abortive organs in the female.

M. A. Forel (who received, at the general session of the previous day, the Schaffly prize for an exhaustive essay on the structure and habits of Swiss ants) gave a very interesting account of the habits of certain ants of mixed colonies; these he divided into classes, the first comprising ants of different species, which live in actual communism and perfect harmony, one as slaves of the other; the second comprising those which sustain a perpetual warfare, the one living in passages mined in the walls of the

* Ought not the state governments to exercise similar jurisdiction over such remains in our own country?

other's formicaries; in this case, sapping is sometimes carried on so extensively as to ruin a portion of the common abode, whence ensues a sanguinary combat, the smaller, weaker mining species only saving itself by taking refuge in narrow passages where the foe cannot follow.

M. Fatio followed with an account of exotic bats which have been known to occur in Switzerland.

Dr. Vouga next read a paper on the Mentone skeleton, and compared the formation of the bone cave where it was found to that of the Grotto of Four, where implements of the stone age have been discovered; he considered the powdery soil of both to have been produced mainly by the incessant fall of flakes of lichen from the ceiling of the cave, and argued from the comparative depth of these deposits that the probable age of the Mentone skeleton was four times that of the implements in the Four Grotto. The same subject was discussed in the geological section, where M. F. Forel maintained that the Mentone Cave relics should be referred to the period of the reindeer, although no bones of that animal had been found in it; he believed the skeleton to be that of an old man, belonging to a wandering tribe of hunters.

The foregoing account embraces that portion of the early proceedings which would especially interest readers of the NATURALIST; but we cannot pass over some other features, suggesting, perhaps, desirable changes in our own plan of procedure. In the first place, the Swiss Entomological Society takes this opportunity of assembling its members. Why might we not still further nationalize our "American" Entomological Society, which never holds a meeting out of Philadelphia?

Again, the eminently social character of this annual assembly is in pleasing contrast with our more formal meetings. The mornings only are given to "papers;" two or three hours each day are devoted to a "banquet" in a large hall, at which the president of the association presides. The annual assessments are made large enough to cover the additional expense and in this instance the wine was provided partly by the "Fribourg section" of the society, partly by the "Conseil d'Etat" of Fribourg. "Vin d'honneur" was the new name given to the Yvorne. Toward the conclusion of the first day's repast, toasts followed in rapid succession. Prof. Vogt favored the assembly with a truly American speech in which "la Liberté" was toasted. In accordance with a suggestion

of Prof. Desor, who recalled the pious custom at ancient festivals of evcking the names of departed friends, all rose in silence at the mention of two most distinguished members, lately deceased — Pictel de la Rive and Escher von der Linth. Dr. Dor greeted the foreign men of science present at the reunion, prominent among whom were Milne-Edwards of Paris and Volpicelli of Rome, and brought the former to his feet amid much applause. Rival cities and rival sections then vied with each other in the interchange of compliments, amid which the hilarity came to an end. All the speeches were voluntary and none occupied more than five minutes.

After dinner each day excursions were made in the vicinity, where, in some private grounds, an unannounced collation awaited the guests; one evening was spent in the cathedral, listening to the far famed organ; on the other evenings the members assembled in the Tivoli gardens, where supper and music were provided. No ladies were present on these occasions nor were there more than two dozen in attendance in the gallery of the main hall at the opening of the general session.

At the meetings, both general and sectional, hand specimens and microscopic objects were freely exhibited, the members constantly crowding to the platform to examine them during pauses in the remarks, the presiding officer joining with them, until, by returning to the chair, he indicated the wish of the speaker to resume.

Excepting the introductory remarks of the President there were no set addresses whatsoever, in marked contrast with the custom of the British Association, where the president of each section inflicts a labored discourse upon his auditors. Perhaps we have struck the golden mean, but the Swiss custom has much in its favor.

Printed lists of the persons present each day were supplied to all in the evening. Each guest was also furnished, on arrival, with dinner tickets, a guide book and map of the city; lodgings were provided free for any who wished to accept. The meeting next year will be held at Schaffhouse, under the presidency of Dr. Stierlin. — *Special Correspondent.*

The recent Meeting of the American Association for the Advancement of Science held at Dubuque has called forth more criticism than has usually been given to the annual gatherings of this important and truly national body, and much that has been said has been adverse to the meeting in a scientific sense. Though

the association has perhaps deserved a little censure for some of its acts, which it is well thus to check before they take root, yet we think that some of the remarks in the daily press have been made through ignorance of the real work of the association, and the special cause of the supposed failure in the "science" of the recent meeting.

It must be remembered that the association has one great object, as expressed by its name; and science is advanced not only by the discussion of papers and facts brought before the association by laborers in its many departments, but also by meeting first in one section of our vast land and then another, thus bringing the workers of all regions together and, by actual contact, cementing the knowledge of the East, West, North and South into a true American Science; and not only is the cementing process to be accomplished by the reading and discussion of scientific papers by the members, but also by bringing the scientists into immediate contact with the people at-large. When we take this broad view, which is, we think, the basis upon which the association was founded, we do not think that any meeting can be called in the least degree a failure because not *all* the brilliant lights of American Science happen to attend, and the papers which are read happen to fall short of the usual number, or fail in presenting startling discoveries and novel facts and theories.

That there was a comparatively small attendance of old members from the eastern and even from the central states was unquestionably owing to the fact that it was generally understood, until almost the last moment, that the meeting would be held in San Francisco, and as the time and expense of attending a meeting there would be far greater than many members could afford, they made arrangements for passing their summer in other regions, giving up all thoughts of going to the meeting this year, and when it was decided to hold the meeting at Dubuque it was too late to change plans made for the summer and prepare papers for reading at a meeting which they had given up all hope of attending. But even this has had a good result, for we think the association, with this experience, will not again leave the place of the next meeting unsettled at its adjournment.

That the Dubuque meeting was in many respects, especially socially, a decided success cannot be doubted; for certainly the greatest interest was evinced by the people of Dubuque and adjoin-

ing places in the objects of the association, and we have seldom seen such hearty good will and fellowship extended to scientists as were given by the citizens and by the great railroad corporations of the west. If appreciation of scientific work by the multitude is one step in advancing science, the results of the last meeting must be considered as most favorable.

Neither can we review the papers received and discussed, and glance over the names of the members present, without feeling that in these respects also the meeting was successful; though admitting that there was not that sharp overhauling of some crude papers which has sometimes taken place to the purification of science. In fact, the only drawback to the meeting was the lack of critical discussion of some of the papers, which were read and allowed to drop without the criticism they would have received at a larger meeting when more persons working in the same field would have been brought together.

The small number of members present (about 188) left several of the subjects which usually have a goodly number of adherents very limited in their support, and though about half of the hundred papers admitted to a place in the programme were referred to the Natural History section, to which we shall confine our remarks, there were not enough to cause the division of the section into subsections, and the bulk of them fell as usual under the head of Geology. In Botany there was but one, and that was the able address of the retiring President, Prof. Gray, which we gave in full in our last number. In Zoology there were the three by Prof. Morse on the "Oviducts of the Brachiopods," the "Embryology of Terebratulina," and "Observations on living Rhynchonella;" the very interesting and carefully prepared paper by Prof. Riley "On a new genus of Tineidæ and the singular connection of the insect with the fructification of the Yucca," which was one of the best papers read in the section; that on "Organic Vigor and its relation to Sex," by Prof. Hartshorne; and one on "Zoological Barriers," by Prof. Orton. In Palæontology, the two papers by Prof. Cope and one by Col. Foster were important in presenting new discoveries; while the paper by Dr. Day on the "Eye of Trilobites," gave an opportunity for a discussion on the position of the Trilobites among the crustaceans.

In Geology, the papers read by President Smith, Messrs. White, Perry, Alex. Winchell, N. H. Winchell, E. W. Hilgard, Andrews,

Hitchcock, Kerr, Cope, Cox and Forshey, presented recent work in the field and laboratory, and were not only in most part ably discussed, but were most instructive résumés of work accomplished and theories advanced. Under this head must not be forgotten the remarks on the recognition of the value of the State Geological Surveys by Prof. Peirce as Superintendent of the United States Coast Survey, which resulted in a memorial to Government calling attention to the desirableness of compiling the results of all the state surveys and publishing them with suitable maps; a most important step for the proper understanding of the geology of the country.

In Anthropology, Col. Foster's paper on the "Crania of the Mound Builders," of which we shall give an abstract in our next number, was the most important, while the short communications by Messrs Woodman and Putnam helped to keep up an interest in this subject. In Microscopy but little was done, though the few microscopists present separated, under the usual subsection, from the Physical section, and had a number of discussions and papers by Messrs. Ward, King, Hilgard, Babcock, Tuttle and Wescott.

The more than usual care with which the Standing and Sectional Committees passed on the papers that were entered on the general list before allowing them a place on the daily programme will be hailed by all members as a step in the right direction. Though a most disagreeable task to perform, it is one that, if carried out to the full extent that it should be as required by the constitution, will do more than any other thing to make the association an exponent of the science of America, and we trust that the example set by the last Standing Committee will be followed next year, so that not only will worthless papers be excluded, but the rule providing for the presentation of abstracts of papers be enforced before allowing papers to go over to the Sectional Committees.

The Committee appointed at the Indianapolis meeting to report if any amendment to the constitution was required regarding membership rendered their report, in which they stated "that they found the constitution fully provided for the points which they had been requested to consider, but that its provisions had been violated, and that they considered a strict adherence to the constitution of vital importance to the association." The clause to which the report was specially directed was that relating to the two classes of members, the active and the associate, and it is under-

stood by the present Standing Committee that the elections next year will be made in accordance with the provision ; and it was very generally expressed that all present members should notify the Permanent Secretary as to the position they wish to hold, either as an active or associate member, it being understood that the class of active members was to contain all who were specially interested in scientific work, while the associates were to be those who joined the association for the purpose of attending the meetings in order to gratify their own tastes or to give pecuniary or personal aid in advancing its objects; the only distinction made between the two classes being that the active members alone could hold office or vote on any matter pertaining to the management of the association.

Among the votes passed was one proposed by Col. Foster, the chairman of Sect. B., providing for a classified index of all the volumes of the proceedings, which would render them of much greater value than now.

In the general discussions which took place among the members much was said regarding the importance of having an official report of the proceedings, which should embody all the discussions, printed daily. The accomplishment of this would be a great advantage to the public as well as to the association, and arrangements could unquestionably be made for it by the employment of regular stenographers, which the rules of the association state shall be employed when practicable.

During the session, excursions were made to the lead mines, spar caves, and other places of interest in and about Dubuque, and a very enjoyable trip was made by rail to the "painted rocks" some 80 miles up the river, and continued by boat to the town of McGregor, where the members and friends of the association were most cordially welcomed and provided with a repast, after which they returned by rail to Dubuque. After the adjournment, quite a number of members accepted the kind offer of passes from the officers of the Illinois Central R. R., and were in succession the guests of the citizens of Ft. Dodge, Springvale and Sioux City, receiving at every place the most generous of welcomes, and assisted in securing the special specimens each was after. The writer of this note will never forget the aid and kindness he received while pursuing his ichthyological and archæological researches among the rivers and mounds of Iowa, and he knows that all

others who were on the excursion unite with him in thanking the many friends they made for the true western hospitality extended and accepted.

The twenty-second meeting of the association will be held at PORTLAND, Maine, beginning on Wednesday, AUGUST 20, 1873, and we believe that the association made a most judicious choice in selecting a place not only easily reached from all sections of the country, but one which will offer the extra inducement of a probably cool season, however hot the discussions may prove, and there will not be the 'bugbear' of "too hot a place to go in August" which has prevented many members from attending the western meetings.

The officers elect for the next meeting are *President*, JOSEPH LOVERING of Cambridge; *Vice President*, A. H. WORTHEN of Springfield, Ill.; *Permanent Secretary*, F. W. PUTNAM* of Salem; *General Secretary*, C. A. WHITE of Iowa City; *Treasurer*, W. S. VAUX of Philadelphia; *Standing Committee*, *ex officio*, in addition to the above officers, J. LAWRENCE SMITH of Louisville, Ky.; ALEX. WINCHELL of Ann Arbor; E. S. MORSE of Salem.

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* Mr. Putnam will not enter upon the duties of his office, except so far as relates to arrangements connected with the Portland meeting, until next summer, and all communications relating to the past meeting must be addressed to Prof. Lovering.

THE

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THE BALTIMORE ORIOLE AND CARPENTER-BEE.

BY REV. SAMUEL LOCKWOOD, PH. D.

DOUBTLESS the ancients were as honest as the moderns. But were they as painstaking and therefore as trustworthy? Those olden treatises on Nature stood upon a sort of exacting didactic dignity of their own, even when they discoursed of marvels akin to

> "The Anthropophagi and men whose heads
> Do grow beneath their shoulders!"

It has always been easier to imagine than observe. Thus has instinct too long been regarded in the beast as the functional equivalent of reason in man; as if man had no instinct, and the beast no reason.* And how vitiating an element has this proved in our natural theology. How many believe the pseudo-axiom that of necessity every bird builds its nest to-day as did its ancestors six thousand years ago? Is not instinct transmitted, or inherited habit? And so there may be relatively new instincts as well as old ones. The trained animal — the setter, the pointer, the retriever—transmits to its offspring those traits which have become the habit, the resultant of long training. The cow migrates to Norway and, contrary to the bovine instinct, eats the fucus off the sea rocks, and finally becomes an eater of fish. Her offspring take to it naturally, that is, instinctively. The mountain parrot, (*Nestor notabilis*) called by the Maories, Kea, is a simple honey

* Pythagoras taught that animals had reason but no mind.—Eds.

eater. This bird has lately found out that mutton is good; and actually combines in flocks to attack sheep, eating the live flesh from the animal's back and sides.

But what has all this to do with orioles and bumble bees? Let us see.

At the beginning of June, I received a small package from Rev. Dr. Campbell, President of Rutger's College. It contained several carpenter-bees, each with its head detached. All the president could tell me, was that they were picked up under a tree in the college campus; and an explanation was asked of the phenomenon. A good deal puzzled, I ventured a provisional statement, a sort of hypothesis which, at least, had the merit of seeming probable. It was shot at a venture and, like such shots generally, it hit wide of the mark. I had just closed quite a long course of lectures on natural history in the grammar school of that institution, and this question, becoming somewhat general, made me feel like one put on his mettle, so I went at it resolved to work out the case if possible.

In the campus were two beautiful horse-chestnut trees, *Æsculus hippocastaneum.* They were large trees, and resplendent with their dense panicles of bloom; every one, as it stood gorgeously upright, seemed a thyrsus worthy the hand of a god. These trees formed the great attraction of honey-seeking insects. It was only under these trees that the headless bees were found, but there they lay in hundreds; the ground was literally speckled with them. Strange to say, the slain insects consisted of but one species and one sex. They were carpenter-bees, of the species *Xylocopa Carolina*, and all were males. Now these males are stingless, and have a white face. I picked them up by handfuls, all headless, the heads lying on the ground. I searched diligently for a head without that characteristic white face which designates the stingless male, but could not find one. Indeed, I entertain no doubt that, of the large number of these decapitated bees, every one was a stingless male. One fact was now apparent, the massacre was made up among the flowers, while the insects were in quest of honey. But what had done it? How was it done? And for what purpose? On these three questions the whole case rested. If they could be answered, the mystery would be solved.

It appeared under the microscope that the severance of the head from the body was clean and not bunglingly done. The head was

not pulled nor twisted off, but cut or snipped off and always at one place, the articulation. But so far the whole affair seemed the result of sheer wantonness, much as I have seen some vicious children beheading flies. The case had become intensely puzzling; for Nature is neither wanton nor wasteful. It seemed to me that no bird would do it, for what could be the object of such waste? Again, it seemed that no strictly aërial insect could do it. Indeed, for an insect to capture and decapitate this great carpenter bee while on the wing or among the flowers, it would require a rare combination, a powerful apparatus for attack and uncommon facilities of flight.

And now was disclosed another wonder. On opening one of these headless insects the body was found to be hollow. Then a number were opened, and every body was found in like manner to be empty. The fact was now apparent that the bodies of all these headless bees had been emptied after decapitation. They had been literally eviscerated at the annular opening made at the neck by the separation of the head. Not a wound nor a mark could be found anywhere on the body. I now began to suspect that the whole was the work of birds. Inquiry was made of the German janitor who seemed pleased to be able to give a direct answer, to the effect, that ever since the horse-chestnut flowers had come out, three or four very beautiful birds had come every day to the trees and had been killing the carpenter-bees. Under the circumstances this information was very opportune. He was not able to give an intelligible description of the birds; so I asked him to watch and shoot one for me, which he did the next day. It was a Baltimore oriole or golden robin (*Icterus Baltimore*). The specimen was a beautiful male, a last summer's bird, hence hardly a year old. Its plumage was perfect, but the colors not so deep as those of a more mature bird.

The Baltimore oriole is an insect and berry eating bird. But here was a new habit of a curious and interesting character. If the Kea turns from honey to flesh, we find our oriole preferring honey to insect food, and resorting to the most singularly ingenious and outré methods to procure it — and with what intelligence! When a boy, in common with his schoolmates the writer often captured the humble-bee, extracted the honey sac and sucked out its luscious contents. How did those four golden robins find out our boy secret? We should rather have said secrets

—for not only did we boys know where the honey lay, but we prided ourselves on knowing that the white-faced carpenter-bees could not sting. As we have shown, our orioles found out this fact also. In their operations they caught the bee on the flower. This of course was done with the bill. The victim was then transferred to one foot and securely held in the claws, while the head was snipped off; then the sharp, narrow bill and tongue were applied to extract the sac containing the valued sweets. From every point of view this new habit appears to us extraordinary; and if these orioles generally get into the secret, it must needs go hard with the carpenter-bees; at least with the stingless ones or, as Patrick observes, those of the male persuasion. And then when we look at the similarity of the acquired new habits in the two cases mentioned, how remarkable the parallelism of the epicurean instincts of the Australian and the American birds! In both cases is there a singular change of the food propensities, and an equally seeming cruel wantonness in gratifying the same. As the poor victims lay before me, I was drawn to think of the old legal barbarity expressed in the judgment, "to be hung, drawn, and quartered;" for, pitiful sight, in my very hand lay these decapitated and eviscerated objects still manifesting a vestige of life in the automatic movements of the legs of the body and the palpi of the head. May it not be asked, if the birds are learning the secrets, and practising the ways of men, and even like them acquiring more refined tastes, whither will the march of intellect lead? At any rate does there not seem to be some connection of our opening homily with orioles and bumble-bees?

NOTES ON THE VEGETATION OF THE LOWER WABASH VALLEY.

BY ROBERT RIDGWAY.

II. PECULIAR FEATURES OF THE BOTTOM-LANDS.

About the middle of September, 1871, I visited Foote's Pond, in Posey County, Indiana, and in company with my botanical friend Dr. Jacob Schneck, of Mt. Carmel, Illinois, spent a day in exploring

its vicinity. This pond is a fine representative of a peculiar feature of the bottom-lands of the western and southern rivers, locally termed bayous,* lagoons or ponds, and in all essential respects is like hundreds of others in the alluvial bottoms of the lower Wabash. Following an old, almost abandoned road through the primeval forest, guided partly by the directions of the people in the neighborhood and partly by the memory of Dr. S. who had been there several years before, we at length discovered, by an opening in the tree-tops, the close proximity of the pond. As we emerged from our tiresome passage through the tangled thickets of button bush (*Cephalanthus occidentalis*) which filled up that end of the pond and grew about 10 or 12 feet high, and stood upon its bank, a beautiful view opened before us. Entirely hemmed in by the surrounding dense forest which extended for miles in every direction, and into whose depths the fronting screen of rank and varied undergrowth prevented the eye from seeing — hiding even the trunks of the foremost rank of trees, there stretched away from us a narrow sheet of water, the calm surface of which was studded with a variety of beautiful aquatics, and its shores ornamented by a belt of extremely diversified herbage, which for variety and luxuriance we have nowhere seen surpassed outside the tropics. Along the shallow margins of the pond were acres of the magnificent *Nelumbium luteum*, its broad circular leaves supported on upright stalks, 2 to 4 feet high, and appearing like a plantation of vegetable parasols, or else resting upon the surface of the water, with the stalks submerged; the wet banks, from which the water had gradually subsided during the summer by evaporation and absorption, were covered by a rank and varied vegetation consisting mainly of *Polygonaceæ*, — among which the drooping racemes of rose-colored or carmine flowers of the *Polygonum amphibium* gave a gay and prevalent color, — and of tall and beautiful grasses and sedges of numerous species; while mingled with these prevailing forms grew, in the moister spots, patches of plants with striking and beautiful foliage and often handsome flowers as the Sagittariæ, and Heteranthera with white flowers, Pontederia with similar habit and blue flowers, Echinodorus, "blue-eyed grass" (*Sisyrhynchium Bermudianum*), tufts of flags (Iris), etc. As we passed along, wading knee-deep, sometimes waist-deep, through this rank herb-

* Pronounced bi-o.

age — often overtopped by tall stalks of marsh mallows (*Hibiscus Moscheutos* and *H. militaris*) bearing large and showy white or rose-colored flowers — we finally found a canoe tied to a willow tree on the bank; this we appropriated for the purpose of investigating the pond itself, and accordingly launched out upon the flower-studded water. We paddled smoothly along at first, over the still, deep water, almost coffee-colored from the decomposition of vegetable matter, but still transparent, and looking down into its depths we could see only a tangled mass of submerged weeds of a moss-like or stringy form; then we brushed through water-lilies and, reaching out, plucked the beautiful snow-white, fragrant flowers of the lovely water nymph (*Nymphæa odorata*) or the yellow ones of the more unpretending "spatter-dock" or yellow pond-lily (*Nuphar advena*). Little yellow, star-like flowers resting on the surface of the water, with their cypress vine-like leaves submerged, were found to be the *Cabomba Caroliniana*, a common aquatic of the Gulf States, and not before found beyond them; while very curious peltate leaves, looking somewhat like miniatures of the great lotus or "yonkapins" (Nelumbium) beside them, but less circular in outline, were *Brasenia peltata*. As we passed plants of the Nelumbium, our canoe would now and then brush against the edge of one of their floating circular leaves, and set it revolving on the water like a wheel. Many leaves of this latter species which we measured were found to be 3 feet in diameter; this species was not then in flower, the blossoms having developed into those peculiar "toruses," or top-shaped seed-cones, containing the edible, acorn-like seeds. Often we had the greatest difficulty in poling our canoe through the intricately tangled mass of floating and submerged weeds,* which appeared to be in almost endless variety, and among which we recognized, besides the species already mentioned, various species of Utricularia, Podostemon, Lemna, Wolffia, Potamogeton, Limnobium and Spongia. Having satisfied ourselves with our examination of the pond itself, we then took leisurely views of its banks, as we passed along over the water. A fronting growth of graceful willows, 20 or 30 feet high, formed the most prominent feature of the shore vegetation, and in the arms of the pond a jungle of Cephalanthus of a lower and denser growth,

* In this connection it may be well to mention that this pond received its name from a Mr. Foote, a surveyor, who attempted to swim across the pond with a surveyor's chain in his hand, and becoming entangled in the submerged weeds was drowned.

with the lower branches bearded with black moss-like pendent tufts of Ramalina. Back of this, on every side, stood the dark tall wall of forest, against which the white arms of the huge old sycamores shone out in striking relief by the strong contrast. Arriving at the shore, and going out into the woods, we found them to be almost completely primitive in their condition, and so dark and silent that one could easily imagine himself in a wholly uninhabited region, there being few traces of the work of the axe, which mar so sadly the beauty of the forests in more thickly settled districts. The fine old trees still stood in all their majesty, above the luxuriant and tangled undergrowth of a virgin forest. The largest trees were, of course, the gigantic sycamores (*Platanus occidentalis*) with trunks 25 to 30 feet in circumference, and of varying length, and a total height of 160 to near 200 feet; but the bur oak (*Quercus macrocarpa*) was very abundant, and had attained an unusual size, very many trunks measuring 18 or 20 feet in circumference, above the larger base, and supporting a wide-spread head of astonishing massiveness. Nowhere else had we seen the sweet gum (*Liquidambar styraciflua*) growing in greater abundance and to such magnificent proportions. In the damper parts of this forest it formed the prevailing growth and seemed to vie with the majestic pecan (*Carya olivæformis*) in its towering height, and on the tall, slender, and perfectly straight trunk, supported a spreading, umbrella-shaped top. Many of these gum trees were, no doubt, 180 feet, or probably more, in height, while the longest shafts appeared to considerably exceed 100 feet in length, and were 16 or 17 feet in circumference. The white elm (*Ulmus Americana*) and honey locust (*Gleditschia triacanthos*) also approached the sweet gums and pecans in size; the height of the largest individuals being carefully estimated at 130 to 150 feet, while their girth, where the trunks became cylindrical, was found by actual measurement to be often as much as 17 feet. Most of the trees of these two species had their branches matted with the parasitic mistletoe (*Phoradendron flavescens*) which plant evinces in this region a striking partiality to these trees. The beautiful catalpa, or "cigar tree" (*Catalpa bignonioides*), grew as a common species among the underwoods and attained a common size of 60 feet in height and over 2 feet in diameter; its foliage was very luxuriant, a leaf plucked from a large tree measuring 18 inches in length by 13 in breadth. The other underwoods were

chiefly pawpaw (*Asimina triloba*), mulberry (*Morus rubra*), sassafras (*Sassafras officinale*), red-bud (*Cercis Canadensis*), iron woods (*Carpinus Americanus* and *Ostrya Virginica*), mixed with numerous other smaller trees, as *Amelanchier Canadensis*, wild plums, crab apple (*Pyrus coronaria*), several species of haws or thorn apples (Cratægus), flowering dogwood (*Cornus florida*), black haw (*Viburnum prunifolium*); while the shrubby undergrowth, which was frequently too dense to penetrate without cutting, consisted in the main of prickly ash (*Xanthoxylum Americanum*), hop tree (*Ptelea trifoliata*), bladder nut (*Staphylea trifolia*), burning bush or "Wahoo" (*Euonymus atropurpureus*), *Cratægus spathulata** and several species of Cornus, besides numerous other shrubs. The prevalent undergrowth, however, consisted of spice wood (*Lindera benzoin*) which grew 10 or 12 feet high, its branches often forming a complete canopy overhead, which entirely shut off the view of the tree-tops.

In the "hollows" parallel to the river, the small cane (*Arundinaria tecta*) formed dense brakes and grew 10 or 12 feet high, the canes matted with thorny "green brier" (Smilax several species) and mixed with tall stinging nettles (Utrica and Laportea); or where the cane was scant or absent, the ground bristled with *Equisetaceæ*. In the more open portions of the woods the herbaceous vegetation was more luxuriant, consisting, in the main, of rank nettles (Urtica and Laportea), tall iron weeds (Vernonia) and silk weeds (Asclepias), associated with an apparently infinite variety of other weeds of similar habit.

In lower spots the "lizard-tail" (*Saururus cernuus*) was the predominant plant, and when in flower imparted a pleasing fragrance to the locality. In the more open glades numerous vines flourished in great luxuriance; grape-vines (of half a dozen species) canopied with their foliage the smaller trees, or ascended to the tops of the very tallest. The winter grape (*Vitis cordifolia*) often grew to a great size, many vines measuring 24 and some 40 inches in circumference several feet from the ground,—sometimes dangling from a branch a hundred feet overhead, as often stretching like a cable from one tree to another, or twisted in fantastic and intricate contortions as they wrapped the trunks or swayed from them. The gaudy trumpet creeper (*Tecoma radicans*) with its vivid clusters of large and conspicuous tubular orange-red

* Heretofore considered of more southern habitat.

flowers accompanied the grape-vines in their riot among the branches, or with the luxuriant poison vines (*Rhus radicans*) adorned the trunks; it was growing to a remarkably large size, a trunk of this species which we measured being 41 inches in circumference at several feet from the root. The splendid *Wistaria frutescens* climbed up the trees and draped their branches; the graceful cross vine (*Bignonia capreolata*) crept perpendicularly up the larger trunks, its dark green, lanceolate leaves, arranged symmetrically in right angles with the stem, and its clusters of trumpet-shaped carmine and yellow flowers, or long pendent pods, the flowers being then nearly all gone, rendering this fine creeper an object of striking beauty. The old decaying trunks, on every hand, were encased in a thick matted covering of the Virginia creeper (*Ampelopsis quinquefolia*), and appeared like huge columns draped in green. Smaller woody vines, as the *Cocculus Carolinus*, moonseed (*Menispermum Canadense*), wax-work (*Celastrus scandens*), green briers (*Smilax rotundifolia*, *S. glauca*, *S. tamnoides*, *S. Walteri!* *S. lanceolata!* and perhaps one or two other species), pipe vines (Aristolochia) and many others screened the shrubbery or festooned the underwood, while a great variety of herbaceous vines, far too numerous to name in full, trailed over the undergrowth or ran up the shrubbery. Chief among these were the virgin's bowers (*Clematis Pitcheri*, *C. viorna* and *C. Virginiana*), the yellow passion flower (*Passiflora lutea*), wild cypress vine (*Quamoclit coccinea*), wild blue morning glory (*Ipomœa nil*), Rutland beauty (*Calystegia sepium* and *C. spithamea*) balsam apple (*Echinocystis lobata*), wild hop (*Humulus lupulus*), wild yam (*Dioscorea villosa*) and carrion flower (*Smilax herbacea*). Besides these were the several species of dodder (Cuscuta) which spread a carpet of orange-colored yarn, as it were, over the herbage, and numerous species of delicate *Leguminosæ*, with handsome pea-like flowers, nestled meekly beneath the ranker herbage, or accompanied the other vines in their spiral ascent. Very often the smaller vines twined around the larger; and in one instance we noticed five species thus ascending one tree. They were *Rhus radicans*, *Tecoma radicans*, *Smilax rotundifolia*, *Celastrus scandens* and *Menispermum Canadense*.

In this neighborhood we found no cypress swamps and did not hear that any occurred there. But about twenty or thirty miles to the northward, just across the mouth of White River and on the

point of land known as "the neck" between that stream and the Wabash, is a cypress swamp of very considerable extent, embracing, according to the report of the Indiana Geological Survey (p. 179), an area of 17,000 acres! I have visited this swamp, but as yet have only just entered its borders, a penetration into its centre being almost a matter of impossibility; and, if possible, is attended by great difficulties and fatigue. In June and July, 1871, I made several attempts to explore to my satisfaction these cypress ponds, but partly from want of familiarity with the locality, and partly from the great difficulties encountered in penetrating the almost impassable undergrowth and débris, became tired out before I had fairly found myself surrounded by cypresses. In these swamps, the bald cypress (*Taxodium distichum*) is, of course, the prevailing growth; but the gigantic pillars of this species overtop a smaller growth of such trees as *Nyssa uniflora*, *Liquidambar styraciflua*, *Gleditschia monosperma*, and such others as require a boggy situation. Though the finest accessible trees of the cypress had been long destroyed, there were yet a few standing which appeared to approach, perhaps to exceed, 150 feet in height, while there were trunks, with immense conical bases, more than 10 feet in diameter. I have no doubt, however, that the almost inaccessible recesses of the swamp contain trees of this species of far greater dimensions. In the portion of the "swamp" which I was able to penetrate, the ground was not overflowed, but moist, or in a few spots boggy, with now and then a lagoon of clear water — clear of trees, but filled up with aquatic plants. One must penetrate such a place before he can appreciate its difficulties; then before he has penetrated fifty feet he is likely to have stumbled over a dozen logs, butted, every few steps, against a cypress "knee" concealed in the rank weeds, and thereby tumbled head-foremost into a thorny bush, or mired in the black mud. After such an experience, stopping on a prostrate log to rest, I prepared to contemplate my surroundings as calmly as I could while wiping the sweat from my eyes, and panting with the rough treatment I had met. Except upward, a view in any direction could not possibly extend beyond a few rods. The tall cypresses stretched their arms overhead, though often they were concealed by the intervening growth of smaller trees, or by the close canopy of button bush (Cephalanthus) and spice wood (Lindera). The fallen trunks, in every position, from an angle of

45°, as when arrested in their fall by another tree, to the prostrate log, were in every stage of decay. Some, as they lay rotting on the damp ground, were as high as the head, and all completely overspread by a varied growth of weeds, which here take a hold upon every available spot, covering as completely the logs and rubbish as they do the ground.

Emerging, in a somewhat dilapidated condition, from this underwood, a beautiful and entirely different scene lay before me; a "pond," but instead of a sheet of dark stagnant water, there spread out before me a sea of green vegetation, with the grasses and sedges waving, and the Nelumbiums nodding, in the gentle breeze, while the graceful, delicately foliaged willows, which fringed its borders, swayed with every impulse of the wind. Above the latter reached upward the spires of the tall cypresses, which stretched out their arms, clad in their fine light green feathery foliage; but even these were overtopped by occasional gigantic sycamores which overlooked the entire forest, stretching out for miles on every side. This pond, which occupied an area of about a mile and a half in length by a maximum breadth of perhaps half a mile, was at this time nearly dry, in consequence of the protracted summer's drought. The bed from which the water had entirely disappeared was covered with a luxuriant growth of handsome and varied species of grasses and sedges, while in the damper spots stood tall blades of Scirpus and Typha; and, in the dryer places, patches of tall marsh mallow (*Hibiscus militaris* and *H. Moscheutos*). Toward the centre of the pond the ground grew gradually moister, and sustained a growth of Pontederia, Sagittariæ, etc., then miry, and supporting the broad circular leaves of Nelumbium, and finally formed pools of shallow water, filled with Nuphar, Nymphæa and other plants, which, being inaccessible to us, we could not determine. As we walked along, about knee-deep in the grasses and *Polygonaceæ* of the dryer border of the pond, we shot a large specimen of *Nerodia erythrogaster*, as it lay on the black mud, from which I did not distinguish it until almost stepped upon. As the moister portions were neared, the great blue herons (*Ardea herodias*) would fly up, startling the intruder with their horridly discordant squawk, sometimes accompanied in their retreat by great white herons (*Herodias egretta*); and once a flock of a dozen or twenty wood ibis (*Tantalus loculator*) were disturbed in their rest upon the branches of an old dead sycamore

that overhung the bank, by a shot which we hazarded at some as they flew from a pool a hundred yards or so ahead of us. In the solitude of such places as this, these birds find secure retreats; and from the half dried-up pools have their fill of fishes, crustacea and reptiles which, when the water becomes nearly exhausted by the summer's drought, are so numerous in the little pools to which they are confined as to keep the water in constant agitation.

THE CALIFORNIAN TRIVIA AND SOME POINTS IN ITS DISTRIBUTION.

BY ROBERT E. C. STEARNS.

In the month of March, 1868, Mr. W. G. W. Harford and myself made a short visit to Monterey for the purpose of collecting, devoting most of the time to an investigation of the outer or ocean shore of Point Piños in the vicinity of the lighthouse. Here are great numbers of granite boulders which have been thrown up by the sea; by wading in at low tide to a depth of two or three feet, and conveying to the shore such stones as could be lifted by us, we were able to make a deliberate and careful examination. Upon the under side of some of the heavy boulders, we found numerous colonies of the corals, *Paracyathus Stearnsii* and *Balanophyllia elegans* (Fig. 144), described by Prof. Verrill of Yale; when first taken from the water and therefore alive, these corals are of a beautiful red color, a shade between orange and scarlet, and vivid as a coal of fire; when dead the stony portion soon fades and becomes a dingy white. Upon these brilliantly colored coral animals, the animal of *Trivia Californica* (Fig. 145, shell, enlarged twice) subsists, at least in part, for I cannot assert that it does not, like other Californians, seek a variety in its bill of fare, and it is not unlikely that it feeds sometimes upon the jelly-like portion of the living sponges.

Fig. 144.

Balanophyllia.

Fig. 145.

Trivia, shell.

The animal of *Trivia Californica* (Fig. 146, enlarged twice) is of the same color as the animal of *B. elegans;* the mantle and

body a vivid orange-scarlet; the body proportionally very much shorter posteriorly and narrower than in *Trivia Europæa* Mont. (Fig. 147, natural size), as figured in Adams' Genera, Vol. iii, pl. 28, fig. 5; towards and at the end of the proboscis, the color tones into a reddish-brown; the eyes are upon slight protuberances upon the outer base of the tentacles; the color of the mantle (which is quite thin and almost transparent) when extended over the back of the shell is neutralized by the purple color of the latter, and the edge of the mantle appears to be slightly waved, and is alternately closely dotted with small whitish and brownish spots; small whitish papillose spots may also be seen irregularly placed on the surface and sides of the mantle; the animal is quite active; from a fancied resemblance to beans, our Spanish Californians residing along the coast call the shells which they frequently find on the beaches, "frijoles." The Trivia is also found in the Gulf of California.

Fig. 146. Fig. 147.

Trivia Californica. Trivia Europæa.

An interesting fact pertaining to the distribution of this and quite likely other related species is worthy of notice. Bodega Head, where in June, 1867, accompanied by Dr. W. Newcomb, I made a collection, is about one hundred and forty miles north of Point Piños, and consists of an abrupt but not very extensive outcropping of coarse granite similar to the rocks of Point Piños; at Bodega I detected the same species of corals and the Trivia, subsequently collected at the Monterey station; the corals seem to affect the harder rock, for at the intervening points where I have made collections, I have been unable to find either of the corals or a solitary Trivia, the coast being composed almost exclusively of the sedimentary rocks.

The common shore shell, *Littorina planaxis*, also appears partial to the granite, though sometimes found on the shales.

From the above it may be inferred, other requirements being present, especially the proper temperature of the water, that the occurrence of the corals is coincident with the presence of the granite, that of the Trivia with the corals upon which it feeds;

it may be that the Littorina, the animal unlike that of the Trivia being a vegetarian, finds its favorite food in some marine vegetable form peculiar to the granite, or that some form of vegetation, which grows upon the shales as well as the harder rock, has some quality imparted to it by the granite which renders it more palatable to the Littorina, and hence its apparent preference for a granitic habitat or station.

THE ALPINE FLORA OF COLORADO.

BY REV. E. L. GREENE.

By means of the collections made and distributed a few years since by Dr. C. C. Parry and Messrs. Hall and Harbour, the botany of the Alpine region of the Rocky Mountains is very well represented to the few who have been able to avail themselves of sets of specimens made by these collectors. Dr. Parry has been collecting in this region again during the past season, and will probably soon be ready to distribute sets that will very beautifully represent this Alpine flora of our West. For the pleasure of many interested parties, who may fail to procure these rare and valuable collections, we purpose giving, through our common friend the NATURALIST, a brief sketch of some of these beauties of the higher mountains, as they appear to one who has more than once visited them in their Alpine homes.

At the altitude of nearly eleven thousand feet, as one passes upward among the pines and spruces which become more scattering in numbers, and more and more dwarfed in stature, because we are rapidly approaching the limit of trees, no one who notices flowers will fail to observe first of all, the brilliant painted cup (Castilleia), the scarlet flowered varieties of which might at first be mistaken for the common *Castilleia coccinea.* But this plant is of a quite distinct species; and notwithstanding the exceeding brightness of its flowers, at this particular altitude, passing as they do into almost every possible shade of red, and sometimes to a beautiful mauve or purple (so that it is difficult to find two different roots producing the same color of flower), its true name is

Castilleia pallida, or pale painted cup; for in the marshes below, say at an altitude of seven thousand feet, and from that point upwards to near the timber line, wherever the plant grows, it bears handsome pale cream-colored flowers. Also above the timber line where it again appears and continues in a very reduced form to flourish at twelve thousand feet, the flowers are pallid again, though with a more decidedly yellowish cast, in the very dwarf and high-alpine variety.

One seldom meets with such exceedingly beautiful wild flowers as are found in just this region of the last of the trees. From their sources on the borders of snow fields just above, noisy streamlets come dancing down, their banks often fairly crowded, and their foaming waters hidden by the luxuriant foliage, and pendent blue flower-clusters of *Mertensia Sibirica*. Where the stream is broader and the water shallow, the splendid *Primula Parryi* almost startles you as you come suddenly upon it, so tropically rich are its light green, showy leaves, and its heavy umbels of large, magenta-purple flowers. Altogether the finest plant of the Rocky Mountains, it seems almost strange that it should have selected its home so near the everlasting snows, and in a region so remote from the haunts of men. It grows usually in thick clumps, in the midst of shallow parts of the streams, its roots running down among the rocks; though sometimes we have found it in very wet, shady ground away from the running waters.

Saxifraga punctata, with very fine roundish leaves, and elegant panicles of pinkish flowers, usually grows in the shallow streamlets with this beautiful Primula, and also *Mimulus luteus*, well enough known in some fine cultivated varieties. In wet shade at about this altitude we find plenty of *Caltha leptosepula*, calling to mind the marsh marigold so abundant in wet meadows on the other side of the Mississippi; but this Alpine species bears only one flower to a stem, the color of which is bluish outside and white within. Nor must we omit to mention the beautiful perennial larkspur (*Delphinium elatum*), whose deep blue spikes are another decided ornament to this region; nor the two very pretty purple-flowered species of Pedicularis (*P. Grœnlandica* and *P. Sudetica*); nor *Parnassia fimbriata* with its beautifully fringed white petals.

In drier soils, among the now dwarfed and scattering pines (*Pinus contorta* and *P. aristata*), we find plenty of a very pretty, small, blue-flowered Polemonium (*P. pulchellum*), and likewise a

variety of *Eriogonum umbellatum*, with cream-colored umbels. And here we must leave unmentioned almost countless species and varieties of Senecio, several interesting saxifrages and crowfoots, and daisy-like Erigerons, and pass upward toward the snows. Leaving below the last of the stunted specimens of spruce and pine and rising to those vast, treeless, grassy slopes that lie just above the limit of trees, we enter upon a new field. Woody plants are yet represented by straggling willows of several species, growing possibly to the height of one or two feet, and often monopolizing considerable tracts of land. One may chance also to find a patch of the rare, high-alpine laurel, attaining a height of perhaps one inch, but bearing beautiful large red flowers. This is supposed to be a form of *Kalmia glauca*. It is however seldom met with. Of herbaceous flowering plants, here at an altitude of twelve thousand feet, there yet remain some splendid examples. *Polemonium confertum*, in its typical form, is one of the finest of this handsome genus; yet this is surpassed by a variety (*P. confertum*, var. *mellitum*) of the same species. The first mentioned form, growing on bleak, open ground, either level or sloping northward or westward, is smaller every way, except in the dark-blue corolla. The variety grows taller, has a luxuriant foliage, and usually pale or almost white flowers. It has gained some excellent points of character by selecting for its abiding places the shelter of high rocks, on the south sides where it is well protected from cold winds and driving storms of snow, which not unfrequently visit these sublime heights, even in August, the flower month; and that, to the greater inconvenience of flower gatherers, than of the flowers themselves. The largest plant of these altitudes is a coarse, hoary composite (*Actinella grandiflora*), growing some eight or ten inches high, and producing heads of yellow flowers as large as those of the wild sunflower of the plains. Here, where so few things rise to the height of more than two or three inches, this species becomes very conspicuous. It usually grows on very exposed situations, and the large heads of flowers, borne upon stout and well clothed stems, turn their backs to the storms, and remain stoically indifferent to the peltings of every sleeting blast that sweeps over their dreary abode. *Mertensia alpina* is one of the most elegant of these tenants of the heights. With its stems, three or four inches high, bearing bunches of deep blue, nodding flowers, it looks remarkably pretty,

and is withal quite showy among so many plants of smaller growth. Here we find two very interesting Alpine clovers, *Trifolium dasyphyllum* and *T. nanum*. The former is much reduced in size, the stems, two or three inches high, supporting the large heads of pink and purple flowers, are conspicuously longer than the leaves. *T. nanum* grows chiefly on very bleak and barren summits, and is yet far smaller. It can scarcely be said to have even a flower-stalk. The flowers, too, are not produced in heads as in other species, but grow either singly, or two together; they are very large, of a pink color, and lie as closely as they can to the matted leaves. The pale green spreading masses of the minute *Phlox Hoodii*, when out of bloom, would very likely be passed by for patches of moss; but now they are dotted all over or fairly whitened with pink-eyed flowers, and are perfectly charming. *Silene acaulis* is another of these matted, mossy, Alpine beauties, with almost stemless, purple flowers. *Saxifraga serpyllifolia*, almost the smallest saxifrage one meets with here, has remarkably large, golden-yellow petals. And now, just a little above us, begin the long, white lines or extended fields of never-melting snows. We hasten to their borders, curious to see what floral beauties have chosen to bloom there; and we find not a few very notable ones.

Within six feet of the snow grows the small but bright-eyed and pretty *Primula angustifolia; Lloydia serotina*, a rather small liliaceous plant, with solitary white flowers; *Gentiana frigida*, a handsome gentian with large corollas, white, marked and speckled with blue, and which are not afraid to expand. *Eritrichium aretioides* is a most elegant, forget-me-not-like plant of about this altitude, growing in very small, silvery masses and sending out very short stems with the very prettiest bright blue flowers. The showiest of all is *Ranunculus adoneus*, a crowfoot with rather stout stems, small and finely divided leaves, and remarkably large and well-formed golden petals. It is certainly one of the very finest species of its genus, and even shows some inclination to produce double flowers. Snow banks that are shut in closely by high surrounding mountains seem as if bordered with gold by the abundance of this plant.

On yet higher and drier points are many more very interesting species, of which we will speak of one here and there. Among some of the highest cliffs one finds in the crevices of the rocks a beautiful small-flowered columbine, a variety of *Aquilegia*

vulgaris. *Claytonia Arctica*, var. *megarhiza*, with large tufts of broad, fleshy leaves, grows on some very barren summits among the rocks, and by the freshness of its appearance in such a place, away above the range of the most dwarfed of high-alpine plants, almost astonishes you. The flowers are quite similar to those of *Claytonia Virginica*, and the whole plant is rather fine looking. It has a marvellously large fleshy root, from which it was named by Dr. Parry, *C. megarhiza.* A little, yellow-rayed composite, with heads of flowers scarcely raised above the surface of the rocky ground, is *Aplopappus pygmæus;* a pygmy indeed in contrast with some of its kindred species of the lower mountains and of the plains. *A. Lyallii* is another very dwarf, high-alpine species less frequently met with.

Talinum pygmæum is a fine little dwarf, looking very like a Claytonia, but producing among its tufts of narrow fleshy leaves numerous very bright purple flowers.

There remain yet many of these Alpine flowers well worth notice; but we are now far above the "music of the pines," looking downward over many a silvery lake, and over many a wide-extended field of dazzling snow. Eastward lies the blue line of distant plains, and near us in the west are piled range on range of snow-streaked, rocky Mountains. The flowers that bloom at our feet we shall forget a moment, and enjoy the wondrous grandeur of this sublime landscape into which our botanizing has so delightfully led us.

CERTAIN PECULIARITIES IN THE CRANIA OF THE MOUND-BUILDERS.

BY J. W. FOSTER, LL. D.*

THE "Kennicott Mound," near Chicago, yielded three frontal bones — the only parts of the skeletons capable of preservation —

* An abstract of a paper read before the Dubuque Meeting of the American Association for the Advancement of Science, Aug., 1872.

After giving an account of the several skulls that he had examined from mounds in Indiana, Illinois and Iowa, with a comparison of them with various other skulls, illustrated by a number of drawings, Dr. Foster gives his conclusions regarding the distinctive characters of the crania of the mound-building race, which we quote entire, preceded by a copy of a drawing of the singular skull from the "Kennicott Mound," and his remarks upon it. We regret that we are unable to print the paper in full, but we trust that it will soon appear in the volume of the Proceedings of the meeting. — EDS.

which were also indicative of a low type. In two instances there was a rapid narrowing in the temporal region; the plates were extraordinarily thick; the superciliary ridges were massive, standing out like ropes; the orbital processes were profoundly notched; and the frontal bone was much prolonged towards the coronal suture. Figure 148, reduced one-half, represents one of these bones. No one, I think, can view this fragment of a skull with its superciliary ridges projecting far beyond the general contour both laterally and in front, and the low flat forehead with its thick, bony walls, without coming to the conclusion that its possessor was a ferocious brute. The prize-fighter of this day might envy such a frontispiece, adapted to withstand any degree of pommelling, or almost even to turn a musket ball.

Fig. 148.

Frontal portion of a Skull from "Kennicott's Mound," near Chicago. a, a, Superciliary ridges.

Distinctive Characters. — The skulls which I have described possess peculiarities which ally them more nearly with the Mongolian race than with the negro or European. They belong in one respect to what Dr. Pritchard calls the *Pyramidal type*, but in other respects they present characters which are *sui generis*. The pyramidal form, seen in cross section, arises from the peculiar conformation of the malar bones, giving an outward sweep to the zygomatic arches.

I append a synopsis of what I regard as the distinctive characters of the Mound-builder's skull, selecting for the purpose the one represented by Fig. 149, which belongs to neither the lowest nor the highest forms; and that the reader may compare these peculiarities with those of the idiot as given by Humphry, I shall, as far as convenient, follow his order of description. It is to be regretted that in all my specimens, with a single exception, the facial bones are wanting.

In examining this skull in its general outlines the observer is struck by the scantiness of brain capacity, seen in the narrow forehead, the receding frontal bone, and a similar recession in the region of the lambdoidal suture, which give to the vertex an undue prominence, and to the longitudinal arc an outline approaching in form a Gothic arch.

That portion of the occipital bone behind the foramen magnum,

Fig. 149.

Typical Skull of the Mound-builder.

a, Glabella. d, Occipital crest.
b, Coronal suture. e, Squamosal suture.
c, Lambdoidal suture. f, Foramen magnum.

instead of being continued in a straight line, as in the well-developed European skull, curves up to the occipital crest. The occipital condyles are small, and "the basilar portion of the occipital bone ascends with unusual obliquity from them." "The foramen magnum and the other foramina for nerves at the base are comparatively large; the foramina for vessels as well as the grooves for the sinuses are, on the other hand, comparatively small." The post-glenoid process, as in the negro, is strongly marked. The occipital crest is highly ridged, and arched convexly like the figure m, and the point where these arches intersect

forms the extremity of the skull. The temporal fossæ are deep and the temporal ridge is prominent. The apex is about midway between the coronal and lambdoidal suture. The parietal plates instead of swelling into a rounded outline, are flattened. The suture connecting the squamous bone with the parietal is less convex than in the European, and in this respect approaches that of the chimpanzee and the lower animals, which is nearly straight. The superciliary ridges are strongly marked and project beyond the general contour of the brain case, and the glabella forms the extreme point of the anterior portion of the skull. The orbits, where bounded by the superciliary ridges and the nasal septum, owing to the deep supraorbital notch, are of a quadrangular shape. The frontal eminences are very slight, which make the superciliary ridges more conspicuous, and the forehead more retreating. The zygomatic arches swell out beyond the parietal walls, which in the European skull so far overhang as to conceal them in the vertical view. From this point of observation it may be said that all the exterior prominences are visible, — the occipital protuberance, the zygomatic arches, and the superciliary ridges.

The frontal bone is of great strength and slopes backward, encroaching on the parietals and giving origin to a low forehead. In the lower animals this bone becomes nearly horizontal and is placed behind the eyes. "In proportion," says Humphry, "as the cranial portion slopes backward, so do its facial buttresses — the nasal and angular processes — slant forwards; and in proportion as the brain is well developed and the cranial part of the bone is upright, so are the facial processes directed perpendicularly downwards. In the lower animals for instance, they grow directly forwards, in the lower races of mankind they grow downwards and forwards, and in the best formed human skulls they grow almost vertically downwards."

Such are the characters which seem to predominate in the mound-builders' skulls,—characters which distinguish them from the negro on the one hand and the Teuton on the other. Individual variations occur, as might be expected, for we are not to suppose that all have been cast in a single mould. All the specimens indicate a low intellectual organization little removed from that of the idiot.

On comparing the figure with a European skull, these anatomical traits will be apparent by contrast; particularly the increased

development of the frontal and parietal regions, the outward curving of the occiput, the horizontality of the line between the occipital ridge and the foramen magnum, and the convexity of the squamosal suture.

It is the preponderance of the brain case over the facial portion of the head that gives to man his superiority as compared with the lower animals; and we estimate the intellectuality and capacity for improvement in the several races of men by the same standard. The skull in size and outline has a general conformity to the enclosed brain. The bony walls take their shape from the nervous tissue, as the shell of the oyster is shaped to accommodate its living tenant. The brain is undoubtedly the seat of mental activity; and, without endorsing phrenology in all its details, we may affirm that a particular form of skull is indicative of particular traits of character. We place the seat of the intellectual faculties in the anterior lobe; of the propensities which link us to the brute in the middle lobe; and of those which appertain to the social affections in the posterior lobe. The predominance of any one of these divisions in a people would stamp them as either eminently intellectual, or eminently cruel, or eminently social. The mound-builders, assuming these skulls to be typical, were doubtless neither eminent for great virtues nor great vices, but were a mild, inoffensive race, who would fall an easy prey to a crafty and cruel foe. Under the guidance of a superior mind, we can imagine that they would be content to toil, without weighing deliberately the nature or amount of the reward. Like the Chinese they could probably imitate, but not invent; and, secure from the irruption of enemies they would, in time, develop a rude civilization.

The Indian possesses a conformation of skull which clearly separates him from the prehistoric mound-builder. And such a conformation must give rise to different mental traits. His brain as compared with the European, according to George Combe, differs widely in the proportions of the different parts. The anterior lobe is small, the middle lobe large, and the central convolutions on the anterior lobe and upper surface are small. The brain case is box-like with the corners rounded off; the occiput extends up vertically; the frontal ridge is prominent; the cerebral vault is pyramidal; the interparietal diameter is great; the superciliary ridges and zygomatic arches sweep out beyond the gen-

eral line of the skull; the orbits are quadrangular; the forehead is low; the cheek bones high; and the jaws prognathous. His character, since first known to the white man, has been signalized by treachery and cruelty. He repels all efforts to raise him from his degraded position; and whilst he has not the moral nature to adopt the virtues of civilization, his brutal instincts lead him to welcome its vices. He was never known voluntarily to engage in an enterprise requiring methodical labor; he dwells in temporary and movable habitations; he follows the game in their migrations; he imposes the drudgery of life upon his squaw; he takes no heed for the future. To suppose that such a race threw up the long lines of circumvallations and the symmetrical mounds which crown so many of our river-terraces is as preposterous almost, as to suppose that they built the pyramids of Egypt.

In the results of archæological explorations, at other points on this hemisphere, we have evidences of the existence of races whose skulls had many of the distinctive features which appertain to those of the mound-builder.

Dr. Lund, a distinguished Swedish naturalist, many years ago in the bone caves of Minas Gordas, Brazil, found the remains of men associated with those of extinct quadrupeds, under circumstances which led him to believe that the whole were contemporaneous. In his communications to the Geographical and Historical Society of Brazil, an abstract of which was forwarded to Dr. Morton by Lieutenant Strain, he says:

"The question then arises, who are these people? Of what race, and what their intellectual perfections? The answers to these questions are, happily, less difficult and doubtful. He examined various crania in order to determine the place they ought to occupy in anthropology. The narrowness of the forehead, the prominence of the zygomatic bones, the maxillary and orbital conformation, all assign to these crania a place among the characteristics of the American race, and it is known that the race which approximates nearest this, is the Mongolian; and the most distinctive and salient character by which we distinguish between them is the greater depression of the forehead in the former. In this point of organization, these ancient crania show not only the peculiarity of the American race, but this peculiarity, in many instances, is in excessive degree, *even to the entire disappearance of the forehead.*"

"We know that the human figures found sculptured on the ancient monuments of Mexico, represent, for the greater part, a

singular conformation of head, being without forehead, the crania retreating backward immediately above the superciliary arch. This anomaly, which is generally ascribed to an artificial disfiguration of the head or taste of the artist, now admits of a more natural explanation, it being proved by these authentic documents, that there really existed in this country a race exhibiting this anomalous conformation. The skeletons which were of both sexes, were of the ordinary height, although two of them were above the common stature. These heads according to the received opinion in Craniology, could not have occupied a high position intellectually."*

Rivero and Tschudi, whose researches in South America command confidence, believe that the artificial disfigurement of the skull which prevailed amongst the Inca-Peruvians owed its origin to the prior existence of an autochthonous race having this peculiarity; and they further state that it is in some instances congenital, as it is seen in the fœtus of Peruvian mummies.

In the Peruvian skull figured by Tiedemann, this peculiarity is also represented.

These authorities would indicate that there was a conformity in the craniology of the earlier races on this hemisphere, embracing the primeval people of Brazil, the platform-builders of Peru and Mexico, and the mound-builders of the Mississippi Valley.

The Peruvian skull, as compared with the Indian, is deficient in capacity being, according to Morton, no greater than that of the Hottentot or New Hollander. In measuring 155 crania of the former, they gave but 75 cubic inches for the bulk of the brain, while the Teutonic crania gave 92 inches. The average difference between the Peruvian and Indian is 9 inches in favor of the latter.†

How is it then, it has been asked, that with this low mental power, these Peruvians should have been able to construct such stupendous works, and develop a very considerable civilization, while the Indian, with far greater volume of brain, exhibits such slight constructive power and has resisted all attempts to elevate his condition? Mr. J. S. Phillips has attempted to answer this question:

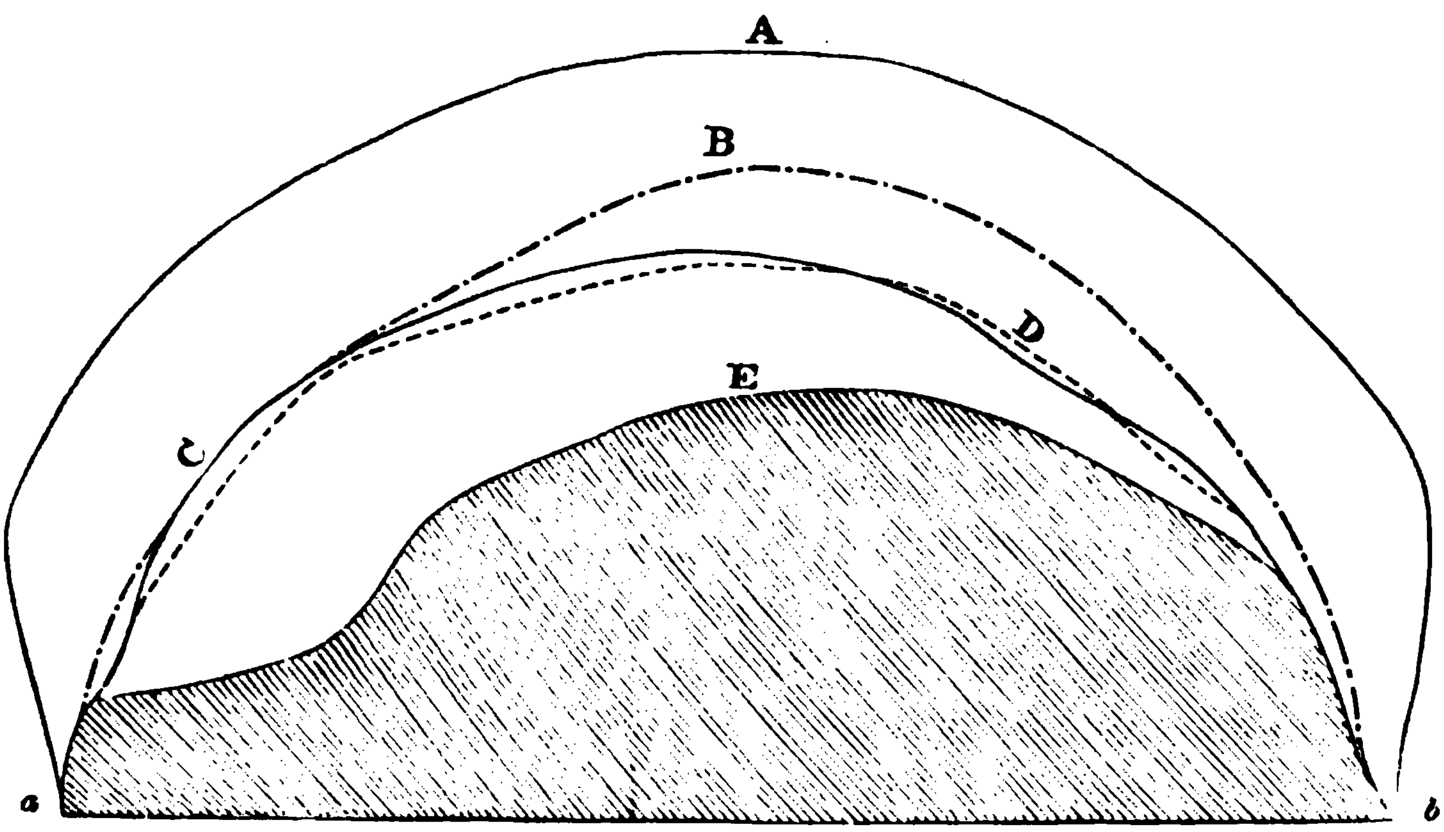
"The intellectual lobe of the brain of these people, if not borne down by such overpowering animal propensities and passions, would, doubtless, have been capable of much greater efforts than any with which we are acquainted, and have enabled these barbaric tribes to make some progress in civilization. * * The intel-

* Jour. Acad. Nat. Sci. Phila., 1844. † Morton's "Crania Americana."

lectual and moral qualities of the Mexicans and Peruvians are left more free to act, not being so subordinate to the propensities and violent passions.*

Below, I give the contours of the most anomalous skulls referred to in this paper, reduced to a uniform scale:

Fig. 150.



Comparative size of different skulls.

A. Contour of European Skull.
B. " " that from Stimpson's Mound No. 1.
C. " " that from the Neanderthal Skull.
D. " " that from the Dunleith Mound, No. 9.
E. " " the Chimpanzee.
a. The glabella.
b. The occipital crest.

So great is the range of variation in the crania of the living tribes of men that it is unsafe to pronounce upon their average capacity except from an examination of a large collection. Thus far but few authentic mound-builders' skulls have been exhumed, and they indicate that that race must be ranked intellectually below the lowest types of Australia and Caledonia.

Leaving out the Engis skull which shows a good degree of intellectuality, it may be said that the earliest types of man are inferior, as indicated by the Neanderthal skull, as well as by those recovered from the Danish and British tumuli, to say nothing of the strange human jaw found by Dupont in Belgium, which approaches

* Appendix to Morton's "Physical Type of the American Indian."

those of the anthromorphous apes, and another jaw of analogous traits found by the Marquis de Vibraye in France, both of which are supposed to be referable to the dawn of the human period. There is nothing to indicate modern degeneracy, whether applied to the intellectual or physical capacity of the Teutonic race. So far from it, there are strong grounds for believing that our remote ancestors lived in brutal barbarism, with modes of thought and daily pursuits far different from those of the educated and much-planning man of to-day; and that, through a state of progression, long continued, often checked, but still acquiring strength to advance, a portion of the human family have been able to attain a high degree of civilization—civilization which implies intellectual culture and an ability to render the forces of nature subservient to human wants and conveniences.

That the investigator may comprehend the relative rank which the mound-builder occupied in what I may call the scale of humanity, I give the following tables of measurements of the crania of the superior and inferior races of mankind, as they exist at this day; those from the United States being taken from "The Military and Anthropological Statistics of the War of the Rebellion," published by the Sanitary Commission under the editorship of Dr. B. A. Gould, and those from foreign sources being reproduced from Huxley:

TABLE OF MEASUREMENTS.

NOTE. If the hair and scalp were removed, the circumference would be reduced from one to one and one-half inches.	Circ'f. around forehead and occiput.	Distance betw'n condyloid processes.			Perp'dr from eyebrows to occipital crest.
		Over forehead and occiput.	Over top of the head.	Over occiput.	
White Soldiers	22·13	11·31	13·31	11·83	14·48
Iroquois	22·48	12·08	13·71	11·58	14·45
Mulattoes	22·00	12·34	14·11	12·24	13·55
Negroes	21·91	10·98	13·95	11·55	14·40

In the following table, while giving the measurement of English and Australian skulls, as well as of those known as the Engis and

Neanderthal skulls belonging to a prehistoric race, I also append, for the purposes of comparison, the measurements of the true mound-builders' skulls described in this paper:

TABLE OF MEASUREMENTS.

NATIONALITY.	A.	B.	C.	D.	E.	F.
English	21	13·75	12·50	4·40	7·87	5·33
Australian (No. 1)	20·50	13	12	4·75	7·50	5·40
" (No. 2)	22	12·50	10·75	3·80	7·90	5·75
Engis, Belgium	20·50	13·75	12·50	4·75	7·75	5·25
Neanderthal, Prussian Empire	23	12	10	3·75	8	5·75
Merom, Indiana (No. 4)	20·50	12·87	11·25	4	7·25	5·50
" " (No. 5)	20·62	12·87	12	3·87	7·37	5·37
" " (No. 6)	19·50	12·50	11·62	4·37	6·62	5·62
" " (No. 7)	21	13·50	12·50	4·12	7·12	6
Chicago, Illinois (No. 1)	20·25	12·50		3·80	7·60	5·75
La Porte, Indiana	18·50	10·50	10·30	3·80	6·50	5

A. The horizontal circumference in the plane of a line joining the glabella with the occipital protuberance.
B. The longitudinal arc from the nasal depression along the middle line of the skull to the occipital tuberosity.
C. From the level of the glabello-occipital line on each side, across the middle of the sagittal suture to the same point on the opposite side.
D. The vertical height from the glabello-occipital line.
E. The extreme longitudinal measurement.
F. The extreme transverse measurement.

ON THE RELATION BETWEEN ORGANIC VIGOR AND SEX.

BY HENRY HARTSHORNE, M.D.*

THE observations of Thomas Meehan upon the relations of sex in plants, published in the "Transactions of the American Association for Advancement of Science," and elsewhere, are entitled to the attentive consideration not only of botanists but also of students of general biology. In his papers of 1868, '69 and later, Mr. Meehan has endeavored to show that "it is the highest types

* Read at the Dubuque Meeting of the American Association for the Advancement of Science, August, 1872.

of vitality only which take on the female form."* His facts have referred mainly to *Coniferæ* and *Amentaceæ*, although not confined to them.

The hesitation felt by many minds in regard to the acceptance of the above proposition has originated, chiefly, from the familiarity of the principle that "there is a certain degree of antagonism between the nutritive and the generative functions, the one being executed at the expense of the other;" along with the weight of some very familiar facts concerning the generally greater size and muscular strength of the male among animals (with a few exceptions, as in certain raptorial birds and arachnida), as well as the equally general superiority of male birds in voice and plumage.

Some of the facts in regard to plants cited in the papers referred to may *possibly* bear a different, even an opposite, interpretation to that given by Mr. Meehan. In his example of the larch, for instance, when we notice that after surviving several years of the repeated production of female flowers, the branches or spurs "bear male flowers and die†," is it not possible that the demand for organic force required in the evolution of male flowers *causes* their exhaustion? In another place ‡ Mr. Meehan speaks of "the loss of power to branch," which in the Scotch pine, "the formation of male flowers induces." This view might comport, at least, with the ordinary statements of physiologists, as represented by Dr. Carpenter § who refers to the contrast between Algæ, in which individual construction is especially active, while the fructifying organs are obscure, and fungi, in which almost the whole plant seems made up of reproductive organs, upon the maturing of which the plant ceases to exist. This contrast between nutrition and reproduction appears again in the larval and perfect stages of insect life; the one being devoted to nutrition and the other to reproduction. Is there any doubt that, in the dahlia and other Compositæ *cultivation* alters *fertile* florets of the disk into *barren* florets of the ray? The gardener's common use of the principle of *limiting nutrition for the increase of reproduction* is alluded to by Mr. Meehan in his paper of 1870,‖ in speaking of a branch being "partially *ringed to produce fruitfulness.*"

* Procd. of Am. Assoc. for Adv. Science, 1869, p. 260.
† Procd. Am. Assoc. for Adv. Science, 1869, p. 257.
‡ Procd. Acad. Nat. Sciences, Phila. 1869, No. 2, p. 122.
§ Principles of Comparative Physiology, p. 147.
‖ Procd. of Am. Assoc. for Adv. Science.

But my purpose in the present paper is especially to call attention to a few well known facts in the animal kingdom, of a character somewhat analogous to those dwelt upon above concerning plants; which conspire with these, in suggesting that some qualification or addition may be required to the ordinary statements concerning the relations between nutrition and reproduction; or at least as to those between organic vigor and sex.

Take the instance of the common hive-bee (*Apis mellifica*). According to the observations of Dzierzon, Von Siebold, Leuckart and Tegetmeier upon hive-bees, and of F. W. Putnam, J. Wyman and Gerstæcker upon humble-bees, it appears that there is a regular gradation in rank, so to speak, of bee offspring, according to the method of their production. First and lowest in the hive-bee series are the males or drones. These may be sometimes produced by an unfertilized working bee; commonly, by a queen bee from ova not fertilized with sperm-cells, which cells, as observation and experiment both have shown, may be for a long time detained in the spermotheca charged with them. A queen whose fecundation has been delayed till she is older than usual, is apt to yield only drone offspring. The next stage in rank is that of the worker, or undeveloped female. Every one knows the remarkable effect of nutrition upon its characters; a change of cell and food elevating it to the full endowments of a queen. Putnam and Gerstæcker* have noticed among humble-bees what are called "large queen larvæ," intermediate between the workers and the perfect queens; and Wyman has suggested that the earlier or later period of impregnation may determine this difference; those first impregnated becoming queens, then the large queen larvæ, next the workers, *last the males.*

Now among the Aphides as well as to a certain extent in some Molluscoida, Cœlenterata, etc., we find a class of facts, different from these but yet allied to them. Taking Huxley's summary of the history of aphidian parthenogenesis,† it seems that the number of successive viviparous *pseudovan* broods is "controlled by temperature and the supply of food." The *agamic* viviparous individuals are regarded by Steenstrup and others as *non-sexual.* If sexual, they must be considered as females undeveloped. At all events, the coming on of cold weather begins the production of

* Packard's "Guide to the Study of Insects," p. 119.
† Linnæan Transactions, xxii, p. 198.

males as well as females. Packard's expression is that "the asexual Aphis and the perfect female may be called dimorphic forms." Of the three forms, then, that one whose production especially attends the conditions of the lowest vitality is the *male*.

But another class of facts of a quite different kind may be considered in this connection; involving higher animals and even man himself. I refer to the history of monstrosities. Double monsters (of which some remarkable human instances have been exhibited within a few years in this country) are always of one sex and *nearly always of the female sex.** There is reason to exclude from this class of true double monsters cases like that of the Siamese Chang and Eng, who may be regarded as really twins with two complete bodies abnormally united together.

Now, why should a double fœtus nearly always have the female sex? The bearing of this question upon that which we have just been discussing appears, when we consider the true theory of double monsters. Under the close investigations of St. Hilaire, Virchow, Vrolik, Fisher and others† it has been made quite evident that they result not at all from the fusion of two embryos into one, but, on the contrary, from the abnormal *fission of a single ovum*, under *excess of formative force*. The point for us now to notice is the nearly constant association of this profusion of developmental force with femininity of sex.

Regarding the actual function of this force (however we may designate it, as, *e. g.*, life force, organic force, bio-plastic force, etc.) as being the formation of plasma with attendant cell-multiplication or *vegetative repetition*, it would appear that *this* is precisely what, in plants and animals, may be the especial feminine endowment. The two directions or modes of manifestation of this organic force are individual construction and reproduction. These may, therefore, be in inverse proportion to each other, simply because the energy or material consumed in the one process is taken from the other; and yet, while a *certain* limitation of food and temperature favors reproduction, rather than individual nutrition and construction, a *greater* lowering of these conditions of vitality will retard, arrest or degrade both processes. According to Meehan's interpretation of his facts concerning plants,

* G. J. Fisher, Trans. Med. Soc. of New York, 1865–1868. Against this I find only a vague expression of W. Vrolik (Cyclop. of Anat. and Physiol., Art. *Teratology*, p. 946) that "some sorts" of double monsters are more frequently male.

† Goodell, Philada. Med. Times, June 15, 1871.

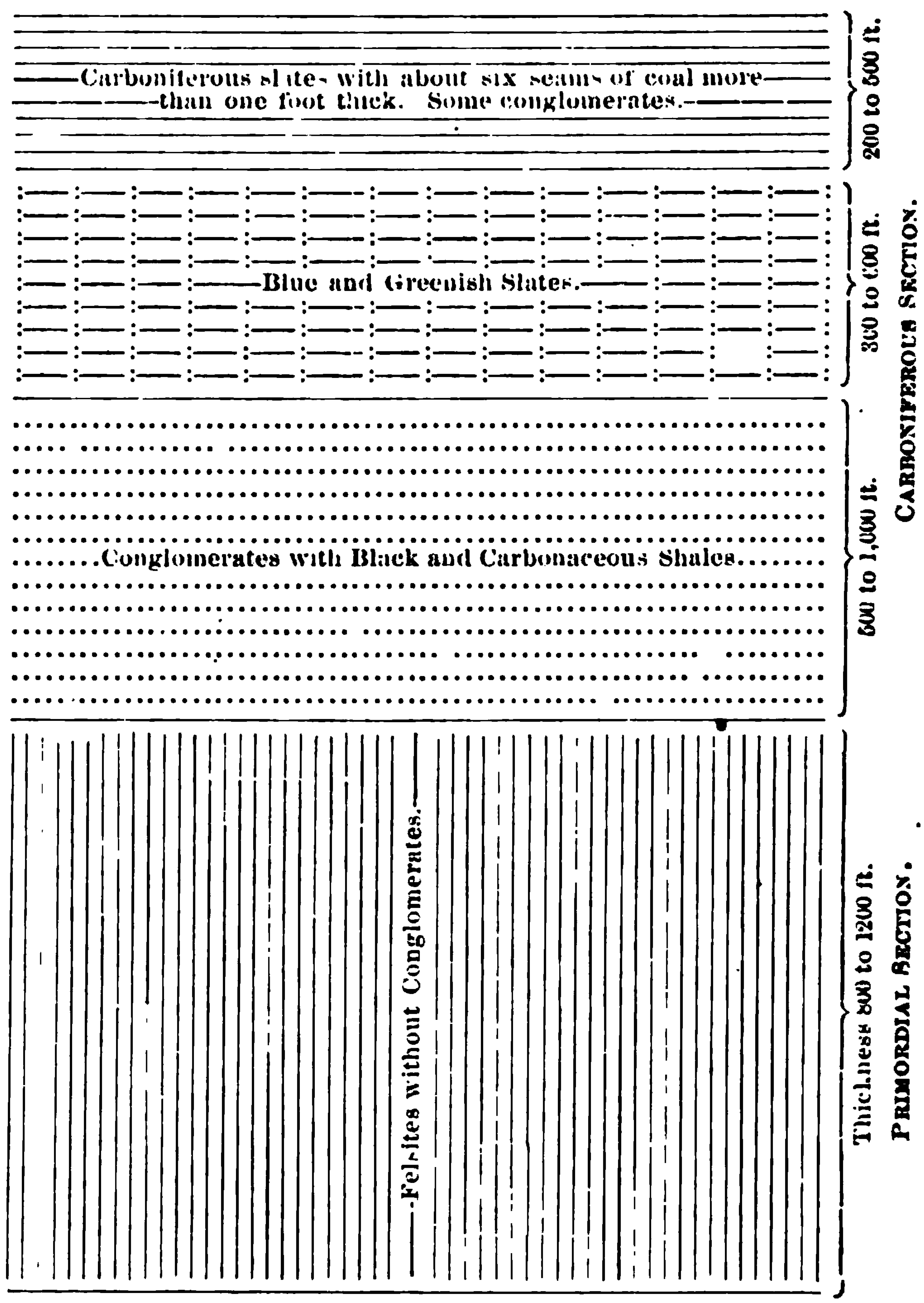
one effect of this lowering, retardation or degradation is the production of the male rather than the female sex. Some facts, at least, in the animal kingdom, as we have seen, support the same view; but to give a statement of this kind the form and validity of a law would require a much more extensive survey of correlated facts. At all events, we do not find the frequent superiority of the masculine sex in certain particulars in the higher animals necessarily incompatible with this; since this superiority prevails usually in apparatus not of the functions of the *vegetative* or organic life, but of *animal* life or of relation; as of *intellection*, *motor* power and *voice*. Beauty of plumage in birds, while we naturally attribute to it a certain superiority, may not, in the scientific sense, unequivocally have this character. If it should be conceded that it has, we must then regard its general predominance in males as one of the difficulties in the way, at present, of any extended or final generalization upon the subject. (The remainder of the paper was occupied with the application of the same course of reasoning to the study of the law of increase of human population.)

ON THE GEOLOGY OF THE ISLAND OF AQUIDNECK AND THE NEIGHBORING PARTS OF THE SHORES OF NARRAGANSET BAY. — No. III.

BY PROF. N. S. SHALER.

PHYSICAL CONDITIONS OF THE CARBONIFEROUS TIME.—The island of Aquidneck is so far separated from the mainland that we cannot directly refer by traced contact any of its rocks to the masses of the shore. It is not difficult, however, to find a dating point in the materials of the island itself. The extensive coal deposits with their abundant carboniferous fossils make us reasonably sure that a large part of the island is composed of rocks which were laid down at the time when the great coal fields of other parts of the continent were being formed. As the rocks of this part of the section are much better determined than those of any other part of the island, it will be well to begin with them and from them to go to those which cannot be so readily placed in their proper positions in the succession of deposits.

Over all the section extending from the Bristol Ferry to the northern end of Lilly pond, we have a set of rocks which must undoubtedly be referred to the carboniferous age, but which vary in some regards from the typical rocks of that age in this country. The exact thickness and the composition of all the members of this series are not easily ascertained on account of the limited nature of exhibitions of strata on the island. The following section is believed, however, to give something like an approximation to the truth :—



The thickness of this section is difficult to determine ; the numerous faults which are apparent in the small part of the area of

the island, where they can be well determined, makes it likely that many occur in the region which is so deeply covered with drift that the observer cannot have a chance of measuring the disturbances they produce.

At the time when the carboniferous beds of the uppermost part of this section were formed, the shore at this part of the continent was not far from its present position. The presence of large quantities of conglomerate with water-worn pebbles in the lower part of the same section conclusively proves this point. From the carboniferous sea an arm or bay having a width of from six to ten miles extended to the northward, with considerable variation in width, as far as Worcester. It is evident that this bay was the estuary of a considerable river, probably a stream of far greater dimensions than any of those which now empty into Narraganset Bay. Down this bay there came at successive times large quantities of detrital materials which varied much in character during the two divisions of the period. During the time of the deposition of the conglomerates there was an immense transportation of fragments from some points in the interior to this shore region. The variety in the chemical and mineralogical constitution of these pebbles is, considering the great tendency there is to equalize their characters by metamorphism, exceedingly great. Some of the materials can be recognized as now in position in the region to the northward but by far the larger part are from rocks which do not, so far as known, occur in the neighborhood. The syenite and other felspathic rocks of the Bristol Neck sections are found in abundance. Other types of syenites also occur which cannot be so easily referred to any bed rock; some geologists have found fragments of Lingulæ in argillaceous pebbles of this formation. These are not known to occur in any rocks to the northward nearer than the Champlain region; it is more reasonable to believe, however, that the source of supply of these fossils has long since been destroyed by erosion, than to suppose that they have been transported from so remote a point. It is quite in accordance with what we know of the erosion of these old rocks to suppose that great masses of these fossil bearing rocks may have been in the immediate neighborhood at the time when these conglomerates were formed and yet these fragments in the newer rock remain the only record of their having existed.

In this view of their history, these conglomerate beds become a most important source of information concerning the ancient geology of this part of the continent. The geologist, in studying the character of glacial drift on this island or any other part of the continent, easily becomes convinced that he has in that mass a key to the geology of the country for sixty miles or more to the northward. Much of the rock within that region whence came this débris is now hidden by similar accumulations of glacial materials, so that the most painstaking student may fail to find its true character, but each gravel or boulder bed is a museum wherein the north lying rocks are more or less well represented. By examining a number of such exposures of the drift it is possible to determine with accuracy the range in character of materials which would be found in the region to the northward so far as Worcester or the neighborhood of Boston. In the same way we may interrogate the conglomerate of the coal period in this region for information concerning the character of the materials of that time exposed to erosive action in this part of the continent. The answer to this inquiry is that the surface of the country was then made up of syenites, porphyries, felsites, argillites and related rocks much as at the present day; some of these rocks contained fossils which may well have lived during the primordial time when they were formed. It is perfectly clear, however, that within the region where these pebbles were formed, there were no rocks of Silurian or Devonian age, else their evident fossils would have been preserved as well as the lingulæ in the pebbles of the conglomerate. This argument gives an important confirmation of the view held by some American geologists, but hitherto resting on insufficient foundation, that New England was elevated above the level of the ocean before the close of the Silurian period. As the region between Newport and the Boston and Albany Railroad contains an assemblage of rocks which may be taken as representative of a large part of the rocks of Massachusetts, it may be regarded as probable that we had, at the time when this conglomerate was deposited, the same conditions prevailing among the rocks of that state as now prevail there. The work of metamorphism which has so much affected the character of the rocks of this region was already done at this the beginning of the coal period. The syenites which have been brought to the surface by the old disloca-

tions which have given the character to the topography of New England were already in a position * to be exposed to erosion.

We have already noticed the close similarity observable between the conglomerate of the primordial time and that which has been produced during the last geological period. It is not easy to find any sharp line of demarcation between the characters of these two detrital rocks. The older conglomerate is always more compact and has usually a trace of bedding, though this feature is often wanting. The pebbles are rather more regularly arranged even where the distortion of the pebbles (a point to be treated hereafter) is least or entirely wanting. Traces of an arrangement of the pebbles as if they had been under flowing water are evident. The fact that at certain points the pebbles have had most, if not all, of the sand and clay washed away between them is a strong proof of their having been exposed to a degree of washing which has been unfelt by more modern deposits. The great similarity in the characters of these two conglomerates, the recent glacial and the carboniferous beds, is strong evidence of relation of origin. The conditions under which conglomerates can be formed are few and peculiar; mountain torrents or the sea rolling upon a shore of rock may form very local accumulations of this nature, but mountain torrents can only make band-like beds or heap up their débris in delta accumulations where their rapid streams merge in water of less carrying force. The sea cannot move pebbles except within the narrow range of its breakers; it rarely has tidal currents which can sweep coarse sand along. The only agent we know to have been generally in action on the earth which is capable of moving pebbles in such a manner as to produce broad deposits of boulders is ice. That it is able to do such work is fully shown by the great accumulations of the drift period. The researches of Mr. James Croll have shown that the conditions which were probably instrumental in producing the last glacial period have operated again and again in the past to effect the same result. There are many points in the great geological section which

* Should it be proven that these Rhode Island conglomerates are of the same age as the materials of similar character in the neighborhood of Boston, we may be able to extend much further this system of reasoning. But it is more than likely, as I shall try to show in the discussion of the geology of Massachusetts Bay, that the conglomerates found there are of still earlier age, having probably been formed during the later stages of the primordial time. Should this conjecture prove true the character of the materials composing these beds will prove an even more interesting key to the ancient history of New England.

show, in the character of the deposits or in the physical condition of the boulders they contain, indubitable evidence of some action other than those usually operative on the surface of the earth. Wherever, as in the nägelfluh of Switzerland or other similar accumulations, we have wide extending shells of boulders and gravel, we are clearly justified in suspecting ice action, when, as in all cases of conglomerates of wide geographical extension which I have examined, the pebbles are not formed with the regular outlines which necessarily occur where the shaping of the masses is the result of moving water. We are bound to believe that pebbles of all sizes, which have been worn to their shape by running water, must tend to assume regular forms, the major axis of which will be coincident either with the greater lengths of the pebbles or with their lines of greatest hardness.

In any case the pebbles will generally assume more or less oblately spheroidal forms. On the other hand, materials which have received their shapes under glacial action will generally be free from those results which come from the uniform friction of one pebble against another, inasmuch as such movements will be impossible while the fragments are in the grip of the ice. The nature of the conditions is such that the pebbles will be worn by being held in a fixed position with one side turned to the abrading agent, the others being for the time protected from wear. With the constant changes occurring in the moving ice one pebble will frequently come to have several facets cut upon it in this way, and many pebbles in succession will be subjected to the same sort of wear. In accumulations of unaltered glacial deposits we always find pebbles having this many faceted character which results from the successive wearing. The only difficulty is that many, often by far the larger part of the mass, are made up of pebbles which have gotten their shape without actual attrition, being simply rounded by chemical action, or keep their original form; but, in any case where many pebbles with a faceted character occur in a conglomerate it may be safely concluded that it has been formed by ice action.

Pebbles having the above described characters occur in abundance throughout the unaltered part of the conglomerate which underlies the Rhode Island coal. This with the other features may be taken making it pretty nearly certain that it had a glacial origin. It must be noticed, however, that in no case have the

pebbles, which have been observed, retained their scratches. In view of the fact that the larger part of our drift beds do exhibit this characteristic in some of their pebbles it must be allowed that this seems a serious difficulty in the way of the hypothesis that the conglomerate pebbles were formed by glacial agency. It is to be noticed, however, that all these conglomerates show the effects of water action in the rearrangement of the fragments and can only be compared with that part of our drift along our shores which has been rearranged in a similar manner. We find on examination that all those beds of drift pebbles which come within the submergence left on our shores have lost the traces of ice action which they generally bear on their surfaces; the facet-like faces are retained, but the scratches are, in all the instances which I have examined, quite worn away. Moreover, the boulders of this ancient period have undergone so much pressure even in those cases where there has been no great mineralogical change, that in almost all the localities which I have examined, distinct marks of change in form are quite evident. Such changes would necessarily have been accompanied by obliterations of such fine exterior markings as glacial scratches. Taking the assemblage of characters observable in this conglomerate, I am inclined to think that it was formed in great part beneath the level of the water, the pebbles and cement being transported by glacial agency and deposited in the ancient sea just as they are now being carried and deposited by the glacial streams on the Greenland coast.

The connection between the carboniferous period and a preceding epoch favoring the deposition of extensive beds of conglomerate is a fact well established both in this country and Europe. The conglomerate and grits which underlie the coal are generally made up of materials which appear to have been transported for considerable distances. This detrital epoch which is so generally indicated by the subcarboniferous formations can best be accounted for by supposing that the forest period of the carboniferous age was preceded by a glacial period of great duration and intensity. During this ice time and immediately succeeding it there would have been, along the shallow border waters of the old continents, great accumulations of pebble beds and sandstones, which would show throughout the stratifying action of water. During the period of reëlevation, which would have followed an ice time then, as it followed the ice time which has just passed away, these beds

of stratified drift would have become covered with a luxuriant vegetation which was in time to be converted into the beds of coal in which its remains have been entombed. The present geological period is a carboniferous period, and in time its coal beds will be found resting upon just such a section as now characterizes the rocks of the ancient coal time. The Dismal Swamp, when it is converted into coal, as it well may be in the future, will show a drift section beneath it where the conglomerates will be composed of pebbles which owe much of their transportation to ice action, though their final arrangement is the work of water. It may be asked why do we not have the unstratified drift and the scratched pebbles of the glacial period which preceded the carboniferous epoch; the answer is easy to find, the shore regions of any continent when the successive submergences keep up the process of deposition, are the only parts of its surface where we can expect to find a record of ancient conditions long before anything like the time has elapsed which has rolled away since the carboniferous period, or the unstratified drift of our shores may have disappeared, leaving only such imperfect record as may be perceived in the bedded conglomerate which may happen to be buried beneath succeeding deposits. The conjunction of conglomerates and coal beds is not limited to the carboniferous period. I am unacquainted with the history of the jurassic and cretaceous coals which occur at various points, but in the tertiary period we see at least twice the same swift change from the desolation of glacial conditions to luxuriant vegetation, which is shown in the period in which we now live, and which I have suspected in the carboniferous time.

The cause of these sudden transitions in climatic conditions is yet to be explained. Apart from the question of the origin of the glacial periods of the past which cannot be discussed here, it is easy to see that the glacial period which has just passed away has done much to favor the development of a luxuriant vegetation over a large part of the country it affected. In the first place the ice work of the glacial time was effective in producing a large amount of well ground material. The surfaces it covered were probably reduced to a state fit for assimilation by plants at a very much more rapid rate than would else have taken place in the same regions under the existing conditions; it must also be noted that the supply of nutriment from the rocks is very much more rapid on a soil filled with glacial material than in one where the action

is by atmospheric erosion alone; every pebble in a gravelly soil wastes over its whole surfaces, so that the aggregate area of supply whence plants can draw their nutriment is many times greater than if it all came from the wearing of the bed rock. There is also the mingling of materials which took place during the glacial period, which has not been without effect in increasing the productiveness of soils. This action has brought into each cubic foot of our boulder clays a great assortment of diverse materials giving a soil ready for the nutrition of any seeds which fall upon it. However varied the demand, it would be sure to find the materials at hand. During the glacial period there was no vegetation in the drift covered region for a period of time which must be reckoned by thousands if not hundreds of thousands of years, so that the materials which came into an assimilable condition remained unappropriated by plants and were in a fashion stored for their future use; when the ice sheet passed away, the soil was left with a rich store of materials suitable for the nutrition of plants. It may be that the vigor of the carboniferous vegetation was in part the result of this glacial preparation of the earth's surface for vegetable life.

The whole time of the formation of this conglomerate was a period of recurring changes of condition. The pebble beds alternate with sandstones and shales and occasionally with somewhat carbonaceous layers of slate. At one point, Wood's Castle, on the eastern shore of the island, the conglomerate is immediately overlaid by carbonaceous shale with faint traces of coal plants; above the coal comes a greenish shale of an unknown thickness. It may be said by some that the juxtaposition of carbonaceous beds makes the glacial origin of the conglomerate doubtful. That this reasoning would be fallacious is well shown by the fact that in New Zealand we have a vegetation more closely allied to that of the carboniferous period than is found in almost any other region growing in the immediate neighborhood of the glaciers. Very slight changes in the conditions prevailing there might bring a vegetation of palms and tree forms upon the débris of the ice streams.

The history of these conglomerates would not be complete without a consideration of the often noticed and much misunderstood compression of the pebbles. The pebbles which make up a large part of the conglomerate which lies to the south of Easton's Beach

and that which is found in the neighborhood of Taunton are usually so nearly in the condition in which it was originally formed that even the accustomed eye fails readily to detect any change in its structure, from compression. At other points to the northward the distortion of the elements which compose the conglomerate is very great indeed. The inquiry into the history of this great change must be made in connection with our study of the dynamic history of the beds of the island.

REVIEWS AND BOOK NOTICES.

THE EVOLUTION OF LIFE.* — An exceedingly interesting and suggestive book, as it is so full of the spirit of Hæckel's writings, of which it is in large part a condensation. We doubt not that it will be extensively read by those interested in natural history studies, though more especially designed to place before the general reader "a condensed view of the evidences for the theory that the animal and vegetal worlds have been very gradually developed or evolved, as distinguished from the hypothesis of their sudden special creation." For the purpose of popular exposition the author's style is excellent, being simple and concise. As we suggested, the work is a reflection of Hæckel's "History of Creation," a remarkable book by a remarkable man. The successor of Oken at Jena, he partakes largely of his spirit, and with much that is strikingly original and suggestive in his popular works, there are portions that are highly exaggerated, facts being sometimes strangely twisted to suit his theory. Hæckel's guesses and assumed intermediate types may be in many cases proved true years hence, but the history of evolution cannot be written by one man in a single century. The "Evolution of Life" must be judged by the same canons of criticism. The impression made on our mind after examining it is, that the author is far more sure of his deductions and grouping of facts than would be a specialist in any one of the classes of animals, whose supposed genealogy he indicates in some cases, at least, with a degree of overconfi-

*Evolution of Life. By H. C. Chapman, M.D. Philadelphia, J. B. Lippincott & Co. 1873 (received Oct. 9, 1872). 8vo. pp. 193. With diagrams and plates. $4.00.

dence. In a word, we doubt whether the candid, cautious zoological expert, though a believer in evolution, would accept many of the apparent conclusions of this taking book. For instance, the homologies of the sponges with the polypes are accepted to their fullest extent by the author, so of the holothurians with the worms, and more especially the supposed passage of the ascidians into the vertebrates. A few explanatory words bridge over the intervals between these grand divisions of animals as if the matter had passed discussion.

In all candor we should say after a second reading of the chapter on Echinodermata, that it is a fair specimen of zoology run mad; but for that matter, though agreeing with the general evolutional views of the author, the errors to which we refer are to be found in the parent of the present work, Hæckel's brilliant and remarkable but faulty "History of Creation," a true child by intellectual descent of Oken's "Physiophilosophy."

We proceed to some special criticisms. Is the animal figured so rudely (many of the figures are exceedingly poor) and described on p. 37 really a Sipunculus? Both the figure and description remind us rather of Synapta. The author on p. 40 adopts Hæckel's strange and misleading view as to the organization of the starfish, in the following language. "The arm of a starfish is, in fact, a worm; not simply resembling one but structurally the same, the segmentation, the water vascular system, the nervous cord in each arm of the starfish being exactly the same as that of an articulated worm [!!]. The starfish has probably been produced through the union of five worms, the worms having united at their posterior ends, since the eyes are seen at the free ends of the starfish [!!!]." This we also find in Hæckel's "History of Creation," though Hæckel figures the embryo of the starfish. Thanks, however, to the labors of Johannes Müller, Professor and Mr. A. Agassiz, and Wyville Thompson, we have such accurate information as falsifies this singular conception. Farther on, Dr. Chapman concludes, and this is a specimen of his over-confident, uncritical mode of dealing with these subjects, that "The origin of the Asteridæ, or starfishes, from the worms is in perfect harmony with the structure, development and petrified remains of the group. The most striking facts of their economy are explainable on such a theory, but are perfectly meaningless on any other." No one whose conception was not founded on mere second-hand,

book knowledge could write like this. We would inquire whether what we know of the embryology of the Comatula from the researches of Wyville Thompson does not point to the evolution of the Crinoids from the lower Radiates, the Acalephs, and further on from the Hydra? From the researches of Müller, Professor Agassiz and Mr. A. Agassiz, the embryos of the three classes seem readily homologized, and the forms of the embryo of the starfish which so strikingly resembles some worms, such as Sipunculus, Balanoglossus and Nemertes for example, are perhaps the result of similar modes of life, and not of genetic significance; farther than that they possibly indicate a protozoan origin. Again, the inadequacy of the author's knowledge of the invertebrates is conspicuous in the statement on page 44 that the "centipedes, insects and spiders are joined in one division, Tracheata," when any text book would have told him that the spiders do not have tracheæ. While, as he says, the Myriopods are composed of numerous segments, "in the insect we can distinguish only three segments known as head, thorax and abdomen." . . . . "So in the Arachnida we find only two segments [!!]." A moment's glance at a specimen would have saved such a sad blunder. The matter is scarcely mended by the statement on the next page that "the numerous segments of which the immature insect and spider are composed gradually coalesce, until finally the perfect insect exhibits only three pieces, the spider two."

Though the portion on the invertebrates is often weak and faulty, the remaining chapters seem to be more carefully prepared, though the tone of the book, like Hæckel's, is that of an advocate, the adverse facts being kept in the background. Read with due caution, the book is a fair résumé of the opinions of many able naturalists as to the probable mode of development of man and the lower organisms.

Illustrations of North American Moths.*—This is a valuable work and worthy of all encouragement, as it gives systematic descriptions (compiled when the author has not had specimens) of the North American (north of the Mexican boundary) species of two extensive and most interesting groups of moths. It offers good

* Illustrations of the Zygænidæ and Bombycidæ of North America. By R. H. Stretch. Vol. 1, parts 1-5. San Francisco, 1872. 8vo. Each part 32 pages. Price, uncolored, 75 cents a number; colored, $1.00. Send subscriptions to author, or the Naturalists' Agency.

figures of species (with cuts showing the venation of many genera), for the most part never before illustrated, or those only figured in costly works. The "Illustrations" will probably extend to about 30 parts, each containing one or more colored plates. Many new Californian species, some of striking interest, are already figured, with good descriptions both of the adult and the larva. Among the most important are three new species of Alypia from California; four species of a beautiful new genus, Kodiosoma, said to be allied to Phragmatobia, the larva of which is said by Dr. Behr to bear "a striking resemblance to that of Syntomis and the cocoon to that of Halesidota; several new species of that elegant genus Arctia, two remarkable species of Sthenopis, a new form allied to *Hemileuca Maia*, and a new Gastropacha, and Notodonta.

The author shows quite conclusively that *Epicallia guttata* is but a variety of *E. virginalis*, as the larvæ of the two forms do not vary.

We also have a description of the larva of *Arachnis picta*, with an interesting account of its habits. The account of the singular genus Phryganidia, regarded as a Psycid by the reviewer, is considered by Mr. Stretch as probably a Zygænid, as "the transformations of *P. Californica*, on which this genus is founded, is so dissimilar to those of the true Psychiinæ, that I remove the genus to its present position though with some hesitation, and chiefly because I feel unable to assign it a more satisfactory position. Not only does the larva, which has some resemblance to Eudryas construct no 'sac,' but it does not even construct a cocoon of any kind, and the pupa is naked and suspended by the tail." We had compared this form with the European genus Heterogynis, but the author remarks that the latter is removed by many European writers to the Zygænidæ. As the larvæ are abundant, sometimes stripping live oaks of their foliage, we hope to receive specimens of the insect in all its stages and study it anew. The larva of *Halesidota Agassizii* is described for the first time, and that of *Drepana siculifer* noticed briefly.

As to the specific distinctness of *Eupupia Americana and E. caja*, we are now inclined to regard the two forms as climatal varieties of a single circumpolar species which runs down both sides of the American continent and on the European side of the eastern hemisphere.

As we are writing this notice, Part V comes to hand, with an excellent plate on which are figured three species (one new) of

Leptarctia, an interesting new genus, of the transformations of which we shall eagerly await information.

We hail with pleasure the appearance of this first work on Californian insects by a native entomologist, and wish it every success.

FOURTH REPORT OF THE PEABODY ACADEMY OF SCIENCE.*—This report is mostly occupied with original papers in natural history, representing the work done in the museum or upon specimens contained in its collections. In his paper entitled "Synopsis of the Family Heteropygii," Mr. Putnam gives a detailed account of this interesting family, represented by the Blindfish of Mammoth Cave, and its allies found in certain subterranean streams and wells and rice ditches of the Southern states, of which a popular account has been given in this journal.

The paper by Mr. Scudder, entitled "A Systematic Revision of some of the American Butterflies; with brief notes on those known to occur in Essex County, Mass.," will afford food for thought to entomologists, and will interest European as well as American naturalists. This important essay "gives a digest of the results reached by a critical examination of the structural features of many American butterflies—principally those of New England. The earlier stages of these insects, as well as the perfect forms have been subjected to careful study." Some sweeping changes have been made by the author both in the classification and synonymy of this important group, based on more thorough study, we venture to say, than has ever before been given to the group. We deem this paper one of the most important contributions to entomology that has appeared for several years.

In the succeeding short papers by Dr. Packard are descriptions of a few new moths from New Mexico and California, and a "List of the Coleoptera collected in Labrador," the specimens having been identified by Dr. Horn.

Appended to the report is the "Record of Entomology for the year 1871." From it we learn that thirty native entomologists have contributed entomological notes and papers during that year. This record is invaluable to entomologists, as showing what work has been done both in America and Europe on our native species.

* Fourth Annual Report of the Trustees of the Peabody Academy of Science, for the year 1871. Salem, 1872. 8vo, pp. 147. Price 75 cents.

We trust that entomologists will aid in supporting this enterprise, and send the small pittance of 50 cents asked for a separate copy.

BIRDS OF KANSAS.*—The first edition of Professor Snow's "Catalogue of the Birds of Kansas" has already been noticed in these pages,† and some of its shortcomings briefly mentioned. We have now the second edition of this work, in which the deficiencies of the first are fully supplied. The number of species has been raised from 239 to 282, and many typographical and other errors amended. Few species probably now remain to be added except such as are accidental or casual visitors. We notice that *Centrocercus urophasianus* has been stricken out, and that among the many important additions are *Garzetta candidissima*, *Herodias egretta*, and *Graculus Mexicanus*, not previously reported from Kansas. The latter (*Graculus Mexicanus*) we are informed was identified by Professor Baird, and forms the first known instance of its occurrence north of the Rio Grande. The nomenclature is that of the ninth volume of the Pacific Railroad Reports, and hence a number of species are admitted that are not now usually regarded as valid. In addition to Prof. Snow's own observations, he has availed himself of all the aid within his reach, and has thus given us a highly valuable and creditable list of the birds of Kansas. It forms a neatly printed pamphlet of 16 pages, and has a less number of typographical errors than similar brochures usually have, though we find "*Ereneutes*" printed for *Ereunetes*, "*Passarella*" for *Passerella*, etc.—J. A. A.

BOTANY.

FERTILIZATION OF YUCCA BY A MOTH.—At the Dubuque meeting of the American Association for the Advancement of Science, Prof. Riley gave an abstract of a paper which will appear in full in the Transactions of the St. Louis Academy of Science. He briefly described the generic and specific characters of a little moth which is one of the most anomalous known to entomologists. He first described how many of our flowers, such as the Asclepias and orchids, were curiously constructed so as to be incapable of

* Catalogue of the Birds of Kansas, contributed to the Kansas Academy of Sciences. By Frank H. Snow, Professor of Natural History and Meteorology in the University of Kansas, at Lawrence. Second edition, Oct., 1872. 8vo. 16 pp. 25 cents.

† Amer. Nat., vol. vi, pp. 359, 482, 483.

fertilizing themselves, and at the same time to attract insects to do it for them. Dr. Engelmann had this year discovered that Yucca was one of those plants which depended on insects for fructification, and Prof. Riley had discovered that the little moth in question, which he calls *Pronuba yuccasella*, is the only insect which can have anything to do with this fructification. But what is more interesting in this case is, that the plant not only depends on the assistance of the moth, but that the moth, in turn, is likewise dependent upon the plant, since its larvæ live on the seeds. We have, consequently, a mutual interdependence which is very striking, and in the structure of the female moth there is a curious adaptation of means to an end by a complete modification of parts, and especially of the maxillary palpi, which are formed into prehensile tentacles, by which she collects the pollen to insert it into the stigmatic tube.

Trees and Rain.— The influence of trees upon rains and the general moisture of the atmosphere, which has been so much discussed of late, receives a strong illustration from the island of Santa Cruz, W. I.

A friend who spent the months of February, March and April last upon the island informs me that when he was there twenty years ago, it was a garden of freshness, beauty and fertility. Woods covered the hills, trees were everywhere abundant and rains were profuse and frequent. The memory of its loveliness called him there at the beginning of the present year when, to his astonishment, he found about one-third of the island, which is about twenty-five miles long, an utter desert. The forests and trees generally had been cut away, rainfalls had ceased and a process of desiccation beginning at one end of the island had advanced gradually and irresistibly upon the island, until for seven miles it is dried and desolate as the sea-shore. Houses and beautiful plantations have been abandoned, and the people watch the advance of desolation, unable to arrest it, but knowing almost to a certainty, the time when their own habitations, their gardens and fresh fields will become a part of the waste; the whole island seems doomed to become a desert.

The inhabitants believe, and my friend confirms their opinion, that this sad result is due to the destruction of the trees upon the island some years ago.— J. S. M.

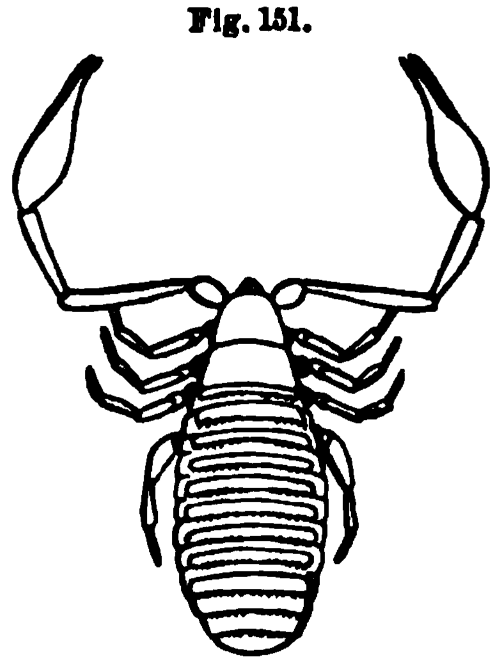
ACER NIGRUM WITH STIPULES.—Mr. J. F. Mills sends a branch of a black maple in which *well-formed foliaceous stipules* are developed, their bases adnate to the petiole. The peculiarity is confined to a single tree, and the like has not been seen before in maples, so far as we know. Mr. Mills should inform us if the peculiarity is reproduced next year.—A. G.

A SEAWEED NEW TO OUR COAST.—This alga (*Hildenbrandia rosea* Kunze) occurs at Mt. Desert, in rocks between low and high water, in similar situations in Massachusetts Bay (Weymouth, Fall River and at Nantucket), and probably all along the coast. —H. WILLEY, *New Bedford.*

ZOOLOGY.

EMBRYOLOGY OF CHELIFER AND PHALANGIUM.—Prof. Metschnikoff, the Russian embryologist, has lately published in Siebold and Kölliker's Zeitschrift, an account of the embryology of Chelifer, of which our *C. cancroides* (Fig. 151) is an example. He remarks in closing "that in view of the great morphological and anatomical similarity between Chelifer and the scorpions we might expect that these animals would be alike in their embryological development. But observation shows that the mode of development of Chelifer reminds us much more of that of the lower Arachnids, namely, the Pycnogonids.* The first embryological occurrence, the segmentation of the yolk, is total in Chelifer, as in the Pycnogonids, Pentastoma and Tardigrades, while the eggs of the true scorpions undergo a kind of partial segmentation. The most peculiar phase in the development of Chelifer, namely, the formation of the larva and its metamorphosis, is at all events much more like the development of the Pycnogonids than the scorpions. I

Fig. 151.



C. cancroides.

* These creatures are considered as Crustacea by perhaps the majority of zoologists. Dr. Dohrn concludes from a study of their embryology that "The Pycnogonidæ are neither Arachnida nor Crustacea; with the former they really have no relationship, with the latter they have, as a common starting point, the nauplius form, but they depart at this point from the course of development of the Crustacea, which continues to go on to the zoëa form.

now refer to the larvæ of Pycnogonum and Achelia described by Dohrn, and especially to the presence of the yolk within the maxillæ of the larva of Chelifer, which circumstance connects it with the embryology of Phoxichilidium.

"It is remarkable that the larva* of Chelifer stands still lower in its grade of development than the nauplius larvæ of Crustacea and the larvæ of the above mentioned Pycnogonids. It indeed presents a nauplius form with only two pairs of extremities, but in all cases the second pair is completely developed (in the form of forked swimming feet) while the same only appears in the youngest larva of Chelifer as a stump-like form.

"In closing I will remark that in its developmental relations Chelifer differs much more from the Araneina (spiders) and scorpions than Phalangium, the Phrynidæ, and even the Acarina.

"The writings of Gerstaecker, Claparède and Zalensky, on the two last mentioned groups, show us that their embryology agrees in many points with that of the Araneina. I can say the same from the development of *Phalangium opilio* observed by me. The embryo of this animal resembles in its general features the well known embryos of spiders, and differs especially through the want of a (provisional) postabdomen, and the relatively less development of the abdomen."

The last number of the "Annales des Sciences" has just come to hand containing Balbiani's memoir "sur la developpement des Phalangides." The eggs and embryo just before hatching were so much like those of spiders, that he mistook them for such. The earlier stages such as Metschnikoff alludes to he does not seem to have noticed.

EMBRYOLOGY OF THE MYRIOPODS.—The only studies on this subject of any special value, previous to the researches of Metschnikoff, are those of Newport on the development of Julus; but these do not relate to the earliest changes in the egg.

In a note to the paper noticed above, Metschnikoff states that he has observed a new instance of the total segmentation of the yolk in the egg of *Polyxenus lagurus* and he believes that this phenomenon is more widely distributed in the insects and crustacea than we suppose. "After the total segmentation of the

* The embryo is here referred to, as the term larva should be restricted to the animal after leaving the egg.—EDS.

yolk, transparent cells separate from the lower pole of the egg, which indicate the germ. In this soon appears a transverse impression whereby the germ becomes divided into two great divisions. Somewhat later the rudiments of six pairs of extremities bud out, of which the first pair, the antennæ, may be recognized by their larger size. The embryo presents in this stage a great similarity to the embryo of Gammarus, especially since the primitive streak arising from the germ is bent bow-like on the ventral surface. An amnion is formed in Polyxenus, also a serous membrane; only a few amœboid cells separate from the germ, which have the greatest resemblance to the egg-amœbæ observed in the Acarina by Claparède and Zalensky, and by me in an Araneid. The germ and embryo of Polyxenus originate from two layers, which correspond to the first two germ membranes of the scorpions and other articulates."

The Kingbird or Bee Martin.—In the rural life of American boys it is always with pleasure that the frequent scene is beheld of the kingbird (*Tyrannus Carolinensis* Baird) attacking the crow; oftentimes we have seen this plucky little creature pursue this great fellow, and alighting on its back "peg into" the great lubber, making it squeak in pain and terror, to our juvenile delight. This sort of persecution every crow must expect that unwittingly passes within a few yards of a kingbird's nest; and so inveterate is the antipathy of these little tyrants, that frequently I have seen three of them pursuing a luckless crow, who was winging a retreat at the highest rate of speed he could command. I have come to the conclusion that Tyrannus is not a kingly bird, but just as mean, and capable of as small dealings as some other folks. In fact, his sallies after the crow are for the most part actuated by a spirit of persecution, and in no sense is he a knight-errant in pursuit of some dark giant oppression. He is a mean, quarrelsome, contentious, selfish, unprincipled little fellow, and my admiration of him has gone plump down to zero. I had occasion a few days ago to visit my friend Captain Swan of Forked River, Ocean County, New Jersey. Opposite his house is a pleasant little grove with croquet ground, etc. The trees are bountifully supplied with bird houses, and the birds find in the captain a protector. He showed me a nest in the crotch of a maple tree, and said that he and his family had watched with great interest a pair

of robins build it. All the time of nidification eagerly watching the progress was a pair of kingbirds. Just as soon as the nest was completed these royal tyrants took possession. Of course there was a determined remonstrance from Mr. and Mrs. *Turdus migratorius*, who had no notion of being thus summarily ousted from a home which with hard labor they themselves had just built. But this king and queen Tyrannus conclusively settled the dispute by showing that might makes right, and Mr. and Mrs. Robin withdrew, as the only way to save their bacon. Having thus "jumped the claim," the kingbirds took possession, and raised a brood of young in peace. One of the young ladies felt her sense of justice so outraged that she wanted to rout the invaders with a broom; but the captain interfered, and they were undisturbed. The very noticeable fact is that these ornithic scamps kept prying around, watching with genuine royal indolence the progress of the labors of the busy unsuspecting builders; then when all was finished, with true kingly impudence they took possession as of royal right.—SAMUEL LOCKWOOD.

ARACHNACTIS THE YOUNG OF EDWARDSIA.—The genus Arachnactis established by Sars for a small floating Actinia has been studied by Busch and myself who came to the conclusion that it probably was the pelagic stage of an Actinoid allied to Cerianthus. During the last summer I have succeeded in raising from young Arachnactis (like those described and figured by me in the Proceedings of the Boston Society of Natural History) somewhat older stages, and to keep them alive till they lost their pelagic habits, and remained more or less stationary on the bottom, creeping slowly along by means of their tentacles on the elongated column.

The changes observed in the older stages of Arachnactis consist of the gradual resorption of the embryonic cells at the posterior extremity of the column, the increase of the number of tentacles, taking place in pairs at one extremity of the longitudinal axis of the disk, the elongation of the column, the increase in size of the ovaries, the differentiation of the column into an anterior part where the partitions are situated, becoming externally more and more corrugated transversally with advancing age, this anterior part being comparatively capable of but slight expansion and contraction, and a posterior part of the column capable of great expansion and contraction, especially at the very extremity of the

column. In fact the Arachnactis has now become a diminutive Edwardsia, with eight partitions from which are suspended ovaries of different lengths, as we find them in Edwardsia.*— A. AGASSIZ.

SWAMP RABBIT (*Lepus Aquaticus*).—This is a widely distributed species. It abounds in the canebrakes of Alabama, Mississippi, Louisiana, Arkansas and Texas. It is found in the portion of country I have named, on all the watercourses, even on the little branches, rarely on uplands. Its flesh is considered the best, most digestible and most nutritious of all the small game. In sugar-cane countries it subsists principally on the leaves of the cane. To procure the leaves of the tall cane, the rabbits will stand on their hind feet and cut the cane in two about fifteen inches from the ground. Being surrounded on all sides with other canes, the stalk cannot fall, but dropping straight down by the side of the stump it remains standing, when the rabbit stands up again and cuts it off as in the first instance, when it drops a second time, and so on, the animal continues to cut off fifteen inch sections until the top of the cane with its leaves comes down low enough to allow the rabbit to feed on it. Many of these little piles of cut up cane are seen in the cany bottoms of the rivers and creeks of Mississippi. Here in Texas where there is no cane, it feeds on various grasses and some of the wild herbage. Like the old field rabbit, when chased by dogs it seeks refuge in hollow trees, holes in the ground, etc. When it is captured it squeals fearfully and its heart beats audibly. —GIDEON LINCECUM, *Long Point, Texas.— Communicated by the Smithsonian Institution.*

THE SALT LAKE CRUSTACEAN.— A peculiarity of the little crustacean (*Artemia fertilis* Verrill), living in the waters of Salt Lake, which ought to be noticed is that of its congregating in masses of strange appearance in the water. When the masses are small they sometimes stretch out so as to have the form of a serpent. At other times they represent rings, globes and various irregular figures. A gentle breeze does not affect the water filled by Artemia, so that while the water on all sides of these dense congregations is slightly ruffled, that which they occupy remains as if covered by oil, thus indicating the figure of the mass. My atten-

* Though this point has not been mentioned before, nor the irregular number of tentacles varying from eighteen to thirty-two in large specimens of Edwardsia, showing that the development of the tentacles has nothing in common with the cyclical development of the tentacles of Madreporarians.

tion was called to them by seeing on the surface the figure of a great serpent in one place, and in another what appeared to be a small stream of comparatively still water flowing out through the lake.

Though I waded out to, and through, these immense bodies, I could not positively ascertain that the individuals were travelling in a common direction; the time was too short to determine this, yet I think it is the fact.—S. W. GARMAN.

A COLOSSAL OCTOPUS.—A letter just received from Mr. J. S. George of Nassau, N. P., Bahamas, mentions a huge Octopus ten feet long, each arm measuring five feet; the weight was estimated at between two hundred and three hundred pounds. The monster was found dead upon the beach, and bore marks of injury.

Fig. 152.

Mr. George adds "this is the first specimen I have seen during twenty-seven years residence in Bahamas, but they are known here traditionally of immense size."—B. G. WILDER.

[We add a figure (152) of a Brazilian species of Octopus. —EDS.]

TEXAS FIELD MOUSE (*Reithrodon Carolinensis?*).—This is a very small mouse, found in the cornfields. They are not very abundant. They dig little holes in the ground, under the side of a rock or tuft of grass, where they breed their young in exceedingly soft beds made of finely shred grass. It is occasionally found, where a

hill of corn has been broken down, that these small creatures have entered the shuck, shelled off the grains, cut out the heart very neatly, leaving the corn in a little heap at one side, looking almost as if it had not been touched. Where corn has been planted alongside of a meadow, their sign is more frequently met with, but never to an extent to cause the farmer to feel any uneasiness on the subject.—GIDEON LINCECUM, *Texas*.—*Communicated by the Smithsonian Institution.*

MARINE CRUSTACEA IN LAKE MICHIGAN. CORRECTION. — I desire to correct an unfortunate error in an article on the Mammoth Cave and its inhabitants (vol. v, p. 752, lines 6, 7), and in the separately printed little work "Life in the Mammoth Cave." I there state that a species representing *Idotea entomon*, found living in the Swedish lakes, had been detected by Dr. Stimpson at the bottom of Lake Michigan. In fact no crustacean of the family to which Idotea belongs is known to exist in our Great Lakes, nor did Dr. Stimpson mention this genus.—A. S. PACKARD, Jr.

ALBINO DEER.—A few days since Henry Wilson of Cape Grove, a short distance from here, killed an albino deer. The head, neck and tail were pure white, while the upper portions of the body and back were so nearly white that you could hardly see the spots. The animal was a fawn of our common Virginia deer, and about three months old. Its eyes were also white.—CHAS. H. NAUMAN, *Titusiria P. O., Volusia Co., Fla.*

GEOLOGY.

THE PROBOSCIDIANS OF THE AMERICAN EOCENE.—During the past summer, Prof. Cope, in charge of a division of Dr. F. V. Hayden's Geological Survey of the territories, explored the palæontology of the Eocene beds of Wyoming Territory. He obtained many species of plants, mollusks and insects, and eighty species of Vertebrata, of which some fifty are new to science.

One of the most important of the discoveries made was the determination of the type of proboscidians prevalent in that period. This is exceedingly peculiar and anomalous in many respects. Proboscidian limbs are associated with a dentition of the same type, when the number and position of the teeth are considered. Thus a huge external incisor only occupies the front

of the upper jaw (premaxillary bone); there is no canine, and the molars are few. The incisor is shorter than in the mastodons, etc., and is compressed, trenchant, and recurved, forming a most formidable weapon. The great peculiarity is seen in the structure of the molars, which is nearly that of *Bathmodon* Cope, an allied Perissodactyl. This type is, however, graded into an approach to Dinotherium in another Perissodactyl, *Metalophodon* Cope, of which more below.

The type species of this group, called by Prof. Cope *Eobasileus cornutus*, is as large as the Indian elephant, but stood lower, having proportions more like the rhinoceros. The elongate form of the cranium added to this resemblance. The physiognomy was very peculiar. On either side of the front, above each orbit, rose a stout horn, its base continuous with that of its mate. The immensely prolonged nasal bones overhung the premaxillary, as in the rhinoceros, and supported on each side near the extremity a massive reverted shovel-shaped protuberance, which united at an open angle with its fellow on the middle line in front.

These beasts must have lived in herds, like the elephant of to-day, judging from the abundance of their remains, no less than twenty-five or thirty individuals having left their bones within a short distance of one of the camps of the party. Three species were distinguished: *E. cornutus*, *E. furcatus*, and *E. pressicornis*.

The resemblance of the tusks to canine teeth is such as to have induced a late author to have based the description of a supposed carnivore of large proportions on one of them.

THE ARMED METALOPHODON.—This is an extinct odd-toed ungulate discovered by Prof. Cope in the lowest or "Green River" division of the Eocene of Wyoming. The only species found was named *M. armatus*. It possessed a full series of six superior incisors, and had a formidable knife-like canine, with cutting edges and a groove on the outer face. The premolars are like those of Bathmodon, *i. e.*, with one outer crescent, while the molars differ in having the constituent crest of the single crescent separated on the inner side of the tooth, thus producing two subparallel crests. The lower premolars are singular in possessing one crescent, with a rudimental second by its side. This increases in proportions on the posterior teeth till on the last inferior molar the two are nearly equally developed. Alternate ridges are however on this tooth

reduced and rudimental, leaving a parallel two-crested tooth, approaching a Tapia or Dinotherium. There were probably tusks in the lower jaw.

The animal was about the size of the rhinoceros and constituted another addition to the well-armed ungulates of the Wyoming Eocene. The transitional forms seen in its tooth structure constitute a point of especial interest.

THE FISH-BEDS OF OSINO, NEVADA. — Investigations into the geology of Nevada, conducted during the present season by Prof. Cope, of Dr. Hayden's Geological Survey, have resulted in the discovery of an extensive lake basin, which was filled with fresh water during some of the Tertiary periods. Its deposits were thrown into lines of upheaval by the elevation of the Ruby Mountain Range, and the North Humboldt River traverses the deepest portion of the old lake. The Humboldt River Sink is its last remnant, bearing the same relation to the Humboldt River as the Great Salt Lake to the Bear River of Utah.

The strata are in many places exceedingly thin and paper-like, resembling the braun kohle of Prussia. Two seams of a cannel-like coal, of about three feet each in thickness, have been exposed by excavations. This is the most western locality for coal east of the Sierra Nevada. The shales contain great numbers of fossil fishes, insects, plants, etc. The fishes are all of fresh water types; one of them is related to the existing type of *Catostomidæ* (sucker), and has been called *Amyzon mentale*. It is a sucker with the sucking mouth "left out;" that part resembling its prototype in ordinary fishes. Another species is related to the "Bull-minnows" (*Cyprinodontidæ*), but differs from known genera in having bristle-like bodies instead of ordinary scales. It is called *Trichophanes hians*. The insects are chiefly mosquitoes and long-legged flies (Tipula).

The age of the beds was thought to be Green River or Lower Eocene.

On the northern ridge bordering the Humboldt valley, Nevada, there are completely opalized portions of trunks of trees which were at least five feet in diameter. The ground is strewn with black, yellow, red, purple or porcelain-white colored fragments. The age of the remains is probably Tertiary and the trees are mostly dicotyledons.

ANTHROPOLOGY.

Antiquity of Man in America.—The discoveries that are constantly being made in this country are proving that man existed on this continent as far back in geological time as on the European continent; and it even seems that America, really the old world geologically, will soon prove to be the birthplace of the earliest race of man. One of the late and important discoveries is that by Mr. E. L. Berthoud, which is given in full, with a map, in the Proceedings of the Philadelphia Academy of Sciences for 1872, p. 46. Mr. Berthoud there reports the discovery of ancient fireplaces, rude stone monuments, and implements of stone in great number and variety, in several places along Crow Creek in Colorado, and also on several other rivers in the vicinity. These fireplaces indicate several ancient sites of an unknown race differing entirely from the mound-builders and the present Indians, while the shells and other fossils found with the remains make it quite certain that the deposit in which the ancient sites are found is as old as the Pliocene and perhaps as the Miocene. As the fossil shells found with the relics of man are of estuary forms, and as the sites of the ancient towns are on extended points of land and at the base of the ridges or bluffs, Mr. Berthoud thinks the evidence is strongly in favor of the locations having been near some ancient fresh water lake, whose vestiges the present topography of the region favors.

MICROSCOPY.

Fungous Growth in Shells.—"In a paper read before the Manchester Philosophical Society on the 26th of February, Mr. Mark Stirrup exhibited sections of shells of mollusca, showing so-called fungoid growths. He referred to Dr. Carpenter's report on shell structure, presented to the meeting of the British Association in 1844, in which especial mention is made of a tubular structure in certain shells, Anomia being cited as a characteristic example. In the last edition of 'The Microscope,' Dr. Carpenter he said, withdraws his former explanation of this structure, and now refers it to the parasitic action of a fungus. Mr. Stirrup showed sections of this shell penetrated by tubuli from the outer

to the inner layers of the shell, and it is upon the inner layer that the curious appearances of sporangia, with slightly-branched filamentous processes proceeding from them, present themselves. The parasitic view is strengthened by the fact that these markings are not found in all parts of the shell, and are certainly accidental. Professor Kölliker maintains the fungoid nature of these tubuli in shells as well as in other hard tissues of animals, as fish scales, etc. Mr. Wedl, another investigator, considers the tubuli in *all* bivalves as produced by vegetable parasites, and that no other interpretation can be given. This view does not seem to be borne out by the section of another shell which was exhibited, *Arca navicula*, in which the tubuli are always present forming an integrant part; they are disposed in a straight and tolerably regular manner between the ridges of the shell; moreover, they have neither the irregularly branched structure nor the sporangia." — *Monthly Microscopical Journal.*

ADVANCING DEFINITION OF OBJECTIVES. — Tolles has lately made a $\frac{1}{18}$ immersion objective for the United States Army Medical Museum, with which Dr. Woodward has produced photographic prints (of Nobert's bands) that far excel any previous work of the same kind. The transparencies on glass are remarkably clear, and the paper prints give the lines in such a startling appearance of relief that it is difficult, even after feeling of the paper, to realize that the lines and the spaces between them are all printed on the same plane. This lens seems likely to replace the now famous $\frac{1}{16}$ as a standard of comparison, the first appeal and the last, for high-power lenses of great pretensions for oblique-light work. If any maker has made or can make, of which last there is no doubt, a lens that will define Nobert's lines better than this, he will confer a favor by presenting to the world proof of the fact. The following note from Dr. Woodward explains itself.

RESOLUTION OF NOBERT'S BAND. — I desire to make public the fact that, since February, 1872, I have received for inspection from Mr. R. B. Tolles of Boston, several objectives ranging from $\frac{1}{10}$ to $\frac{1}{20}$ (maker's nomenclature) which resolved the nineteenth band of the Nobert's plate in my hands. Last month I received from Mr. Tolles an objective made to fill an order of long standing for the Army Medical Museum. The immersion front of this objective (marked $\frac{1}{18}$ by the maker) separates the lines of Nobert's

plate, *from the lowest to the highest band, more satisfactorily than any objective I have hitherto tried.* I must also give its performance on *Amphipleura pellucida* by lamp light the preference over any similar work I have done or witnessed. The price of this objective was one hundred and seventy-five dollars.

I send herewith some glass transparencies from negatives of the nineteenth band, taken by this lens, together with some paper prints of the several groups of the plate.—J. J. WOODWARD, *Washington, Sept. 3d.*

PHOTO-MECHANICAL PRINTING.—In the September number of the NATURALIST is an article under this caption, giving some of Dr. Woodward's ideas, and an editorial dissent from them. Now this difference of opinion relates to a point that ought to be settled by the judgment of microscopists, and I write this for the purpose of calling for their views of the question. I quote from the article: "Even the microscopist himself, being unable to represent all that he sees, is obliged to select what he conceives to be of importance, and thus represents his own theories rather than severe facts" (*Dr. Woodward*). The comment is ["If, however, his theories are correct, and his delineation skilful, this very power of selection and construction enables him to give a distinctness and completeness which is lacked by the photographic camera."]

Here are two almost opposite principles of illustration in question. Which should be the governing one? What is the object of the pictures? Obviously there are two; one for explanation of the observer's theories; the other, that other observers may in repeating the observation be guided by and recognize what the first one had seen, and this I consider the all-important object of "figures." If the observer draws only what he thinks important, he must almost invariably make a picture quite different from the one seen in the microscope — he has omitted what he deemed the unimportant parts — and the pupil trying to follow him finds the actual appearance so different that he does not recognize it as the same. No doubt many of the misunderstandings or differences of opinions among microscopists have originated from this very defect of published figures, which have been taken to be what they purported to be, representations of what was actually seen — "if his theories are correct;" but if his theories are wrong then his skilful delineation has only misled

his readers. But if the draughtsman publishes his figure as explicitly as his theory, not as the representation of the "severe fact," then he will be understood.

On the other hand, the camera represents exactly what may be seen by any other observer, *using the same appliances* (which should in all cases be described) and the student can draw his own conclusions from the picture as to the soundness of the theories advocated. But then it must be remembered that a photograph can represent only one view of an object, while the observer by changing the focus of his instrument obtains a new view at each movement of the screw. With the high power lenses now in use, these differing views are all important for correctly understanding almost any object. Therefore scarcely anything can be properly illustrated by one photograph. Many objects must require several. —C. S.

This inflexible limitation of the photographic view to one section or plane of the object, is evidently one of the points referred to in the criticism quoted above, which, without referring to photography as a means of proof of alleged observations, or of submitting observations to investigators for criticism or deduction, only suggested that for communicating well ascertained facts a skilful delineation may contain more information than any available number of photographic representations. A good drawing, as intimated by Dr. Beale, may often supply the place of a long and unread verbal description.

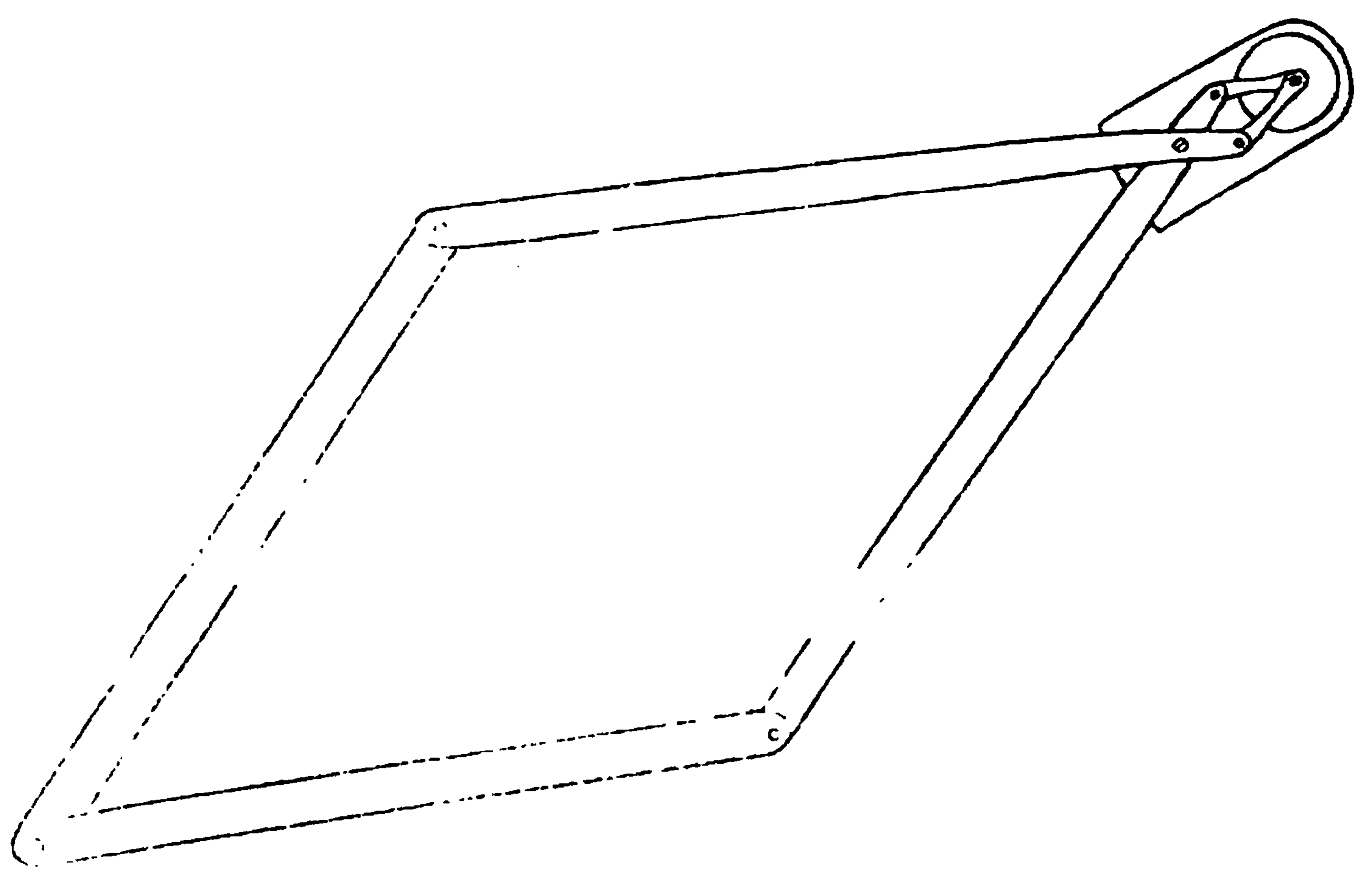
THE SUBMERSION MICROSCOPE. — Mr. Richards has presented to the Royal Microscopical Society an adjustable submersion tube which can be attached to any objective, thus avoiding the necessity of having a tube specially fitted to each objective which is to be used in this manner.

Dr. Dudgeon's paper in the "Quarterly Journal of Microscopical Science" for July, 1871, seems to claim originality for the idea of a submersion arrangement, but Mr. Richards and others have called it Mr. Stephenson's plan. We hope our London contemporaries will settle this question of priority, and give us the facts immediately. All the submersion arrangements are but slight variations of a single idea, and that for the present we credit to Dr. Dudgeon.

THE MICRO-PANTOGRAPH. — Mr. Isaac Roberts publishes in the July number of the "Monthly Microscopical Journal" an illus-

trated description of a most important piece of apparatus. He undertakes to avoid the difficulties of the method of drawing by the camera lucida by substituting an instrument (Fig. 153) which shall present a fixed though large ratio between the movements of the pencil point on the paper and of a given point in the focus of the eye-lens of the ocular. A method previously in use and very easily used, for enlarging or reducing drawings is combined now, for the first time, with the microscope. Two parallelograms of light rods are constructed having their adjacent sides inflexibly connected with each other. All the intersections of the sides are pivoted so as to have a free horizontal motion, and the intersec-

Fig. 153.



tion of the two parallelograms is made a fixed point by screwing it to a brass plate which slides into the ocular in the usual position of a micrometer. The pivot at the outer end of the large parallelogram carries a pencil, and in the corresponding position in the small one is a glass plate with cross-lines ruled upon it. When in use in the microscope the cross-lines are in focus of the eye-lens, and the pencil rests upon a sheet of paper suitably supported near the top of the compound body. The pencil is to be so moved as to cause the intersection of the cross-lines to pass over the parts of the object desired to be delineated. Such a drawing would probably surpass in accuracy any other that could be made.

Mounting Tissues in Balsam. — Portions of thin membranes, or of other tissues, especially when stained with carmine, silver or gold, may be transferred through alcohol to balsam by the following method described by Dr. J. J. Woodward. The preparations are examined in glycerine on a glass slide and under a thin glass cover, and they may be kept in this condition, without further preparation, for several weeks. When one is to be permanently preserved the cover is to be fastened down by a spring clip, and the whole arrangement immersed in seventy-five per cent. alcohol for a few days; after which it is transferred, for the same length of time, to absolute alcohol. The object may then be removed from its position under the cover, and it will be found sufficiently dehydrated to be mounted in balsam in the ordinary way. By this transfer to balsam, permanency is gained and corrugation and distortion are reduced to a minimum.

Mounting Tissues in Dammar Varnish. — Dr. J. W. S. Arnold transfers sections of stained tissues from water to seventy-five per cent. alcohol. After soaking ten or fifteen minutes, the specimen is clarified by oil of cloves and immediately mounted in dammar varnish or balsam dissolved in chloroform. The distortion caused by absolute alcohol is avoided, and the objects are rendered sufficiently transparent.

Logwood Staining Fluid. — Hæmatoxylin is preferred to carmine as a means of staining tissues, by some microscopists. Dr. J. W. S. Arnold prepares the solution by rubbing together in a mortar one part of common logwood extract and three parts (by measure) of pulverized alum, and afterwards gradually adding enough water to dissolve only a part of the powder. The saturated solution thus formed should be of a dark violet color. If too red, more alum must be added. After standing several days it is to be filtered and diluted by one-fourth its bulk of seventy-five per cent. alcohol.

Fungi in Drinking Water. — Prof. James Law found fungi in the blood and in the milk of cows who drank water abounding in diatoms and spores. The health of the cattle was manifestly impaired. Only a part of the cows drinking the water were susceptible to its effect, and they recovered after a change of water and the use of bisulphate of soda. The organisms observed are figured in "The Lens."

Structure of Podura Scales. — Dr. J. W. S. Arnold has succeeded in throwing off, by means of the electric induction spark, some of the "spines" of the familiar test scale of "Podura." Preparatory to this experiment the scales are rendered brittle by drying in an oven. The detached spines are easily beaded by unilateral light.

Dry Rot. — Thomas Taylor, of Washington, D. C., found microscopic fungi upon the leaves of a book which was gradually perishing by dry rot. After treatment by a strong solution of carbolic acid, no further injury occurred.

NOTES.

Captain Scammon announces the speedy publication by subscription of a new work on the "Cetaceans and other Marine Animals of California." The plates are to be full and finely executed. Professor Agassiz commends it as follows.

San Francisco, October 1, 1872.

My Dear Sir: I have been delighted to look over the engravings of the cetaceans and other marine mammals of the West Coast of North America, to illustrate your work upon their natural history, because it is the first time I have seen the whale properly exhibited on paper.

Your practical knowledge of these animals, and the faithfulness of detail and excellence of the representations, will make the work standard; and it will give me the greatest pleasure to do everything in my power to obtain subscribers for you in the Atlantic States and in Europe.

With the deepest interest in your labors, believe me

Very sincerely yours, L. Agassiz.

To Capt. C. M. Scammon, *U. S. Revenue Marine, San Francisco, California.*

We are able to announce that the work will be published by the Naturalists' Agency, and that we are ready to receive subscriptions at this office and shall soon be able to give further information.

We have to record the death, after a short illness, of Andreas S. Oersted, Professor of Botany in the University of Copenhagen, which occurred on September 3d. He was born on June 21st, 1816, and his earlier studies were directed to zoology; in 1841 he obtained the gold medal of the university for a thesis on the Danish Annelids. During the years 1846–48, Oersted travelled in Costa

Rica, and the botanical results of his expedition have appeared in numerous papers in the Transactions of the Copenhagen Natural History Society, and in a series of memoirs on different natural orders, in conjunction with Bentham, Berg, Griesbach, and Planchon. In 1863 was commenced "L'Amérique Centrale" which contains descriptions and figures of new tropical American plants. Oersted's researches in fungi were important, especially his demonstration that Rœstelia is but a dimorphic condition of Podisoma, and his investigations into the organs of reproduction in Agaricus. He was appointed Professor in 1860.—*Journal of Botany.*

A RARE opportunity is offered for those who want a collection of Californian Coleoptera, and insects of other orders. Mr. G. R. Crotch, late assistant librarian at Cambridge University, England, proposes to spend about a year on the Californian coast, going as far south as Guaymas, and then up to Vancouver Island. Mr. Crotch will make a specialty of Coleoptera, which will be named by Dr. Leconte, and made up into sets at ten dollars per one hundred species, two specimens being given whenever practicable. He is willing to collect other orders if wanted.

WE take pleasure in drawing attention to the Essex Institute course of eight lectures entitled "Eight evenings with the Microscope," now in course of delivery in Salem, by Rev. E. C. Bolles. The subjects are "With the Microscope Maker," "In the Laboratory," "In the Garden," "In the Forest," By the Pondside and Seaside," "Among the Insects," "With the Zoologist," "With the Polariscope and Spectroscope." These subjects are most clearly, pleasantly and ably handled by the lecturer. The illustrations enlarged by the microscope and thrown upon a screen twenty-five feet in diameter, by aid of two powerful calcium lanterns, are simply splendid, and we doubt if more finely illustrated lectures for a popular audience have ever before been presented in this or any other country.

A NEW society has been organized in Sacramento, California, under the name of the "Agassiz Institute," with the following officers: — Dr. T. M. Logan, President; F. E. Potter, Recording Secretary; Rev. J. H. C. Bonté, Corresponding Secretary. We are informed that the new society has been formed on the model of the Essex Institute of Salem, and that it owes its birth in great part to the recent visit of Prof. Agassiz, after whom it is named.

BOOKS RECEIVED.

Corals and Coral Islands. By James D. Dana. New York. Dodd and Mead, 1872. 8vo pp. 398. Illustrated with woodcuts, plates and maps.

Man in the Past, Present and Future. A popular account of the Results of recent scientific Research as regards the Origin, Position and Prospects of the Human Race. From the German of Dr. L. Buechner, by W. S. Dallas, London. Phila., J. B. Lippincott. 8vo, pp. 363.

Evolution of Life. By Henry C. Chapman, M.D., Philadelphia. J. B. Lippincott, 1873. 8vo, pp. 193. Illustrated.

Catalogue of Microscopical Preparations in the Cabinet of the Queckett Microscopical Club. 8vo, pp. 39. London, 1872.

Seventh Report of the Queckett Microscopical Club. 8vo, pp. 58. London, 1872.

Intermembral Homologies. By Burt G. Wilder, M.D. 8vo, pp. 88. Boston, 1871.

Fifty-fourth Annual Report of the New York State Library. 8vo, pp. 156. Albany, 1872.

Notes on the Post-pliocene Geology of Canada; with especial reference to the Conditions of Accumulation of the Deposits and the Marine Life of the Period. By J. W. Dawson, LL.D. 8vo, pp. 112. 6 plates. Montreal, 1872.

Tidsskrift for Populære Fremstillinger af Naturvidenskaben. Fjerde binds fjerde hefte. 8vo. pp. 241–324. Kjobenhavn, 1872.

Discovery of Fossil Quadrumana in the Eocene of Wyoming; Note on a new genus of Carnivores from the Tertiary of Wyoming; Notice of a New Reptile from the Cretaceous. p. 1. From the American Journal of Science and Arts, vol. iv, November, 1872. By O. C. Marsh. Published October 8, 1872.

Notice of a new species of Tinoceras. (From the Amer. Jour. Sci. and Arts, Oct., 1872. By O. C. Marsh. p. 1. Published Sept. 21, 1872.

Notice of some Remarkable Fossil Mammals; Notice of a New and Remarkable Fossil Bird. (From the Amer. Jour. Sci. and Arts, vol. iv, Oct., 1872.) By O. C. Marsh. pp. 2. Published September 27, 1872.

Preliminary Description of New Tertiary Reptiles. Part II. (From the Amer. Jour. Sci. and Arts.) By Prof. O. C. Marsh. 8vo, pp. 6. Published Sept. 23, 1872.

Materiaux pour la Faune Belge. Deuxieme Note, Myriapodes. Par Felix Plateau. 8vo, pp. 21, with 2 plates. Bruxelles, 1872.

Qu'est-ce que l'aile d'un insecte? Par Felix Plateau. 8vo, pp. 10, with 1 plate.

Descriptions of New Species of Birds of the Genera Icterus and Synallaxis. By George N. Lawrence. 8vo, pp. 2. (From Ann. Lyc. Nat. Hist., N. Y.)

Twentieth Annual Report of the Regents of the University of the State of New York on the condition of the State Cabinet of Natural History and the Historical and Antiquarian Collection annexed thereto. Revised edition, 1870. Large 8vo, pp. 448. 25 plates. State Document.

Catalogue of the New York State Library, 1872. Subject Index of the Several Libraries. 8vo, pp. 651. State Document.

Fifth Annual Report of the Trustees of the Peabody Museum of American Archæology and Ethnology. 1872. 8vo, pp. 35.

Notes on Chalcidiæ. Parts v, vi, vii. By F. Walker. London, 1872. 3 pamphs., to p. 129. 8vo.

Proces Verbal de la Societe Malacologique de Belgique. April 7–July 21, 1872. 8vo.

Fourth Annual Report of the Trustees of the Peabody Academy of Sciences, for the year 1871. 8vo, pp. 148.

Underground Treasures: How and where to Find Them. A Key for the ready determination of all the useful minerals within the United States. By James Orton. Cloth, 12mo, pp. 137. Illustrated. Hartford: Worthington, Dustin & Co. 1872.

The White Coffee-leaf Miner (Cemiostoma coffeellum Stainton). A Report as Entomologist to the Government of Brazil. By B. Pickman Mann. (Reprinted from the American Naturalist.) 8vo. pp. 21, and plate. 1872.

Report of the Geological Survey of the State of New Hampshire, showing its progress during the year 1871. By C. H. Hitchcock. 8vo, pp. 56, and map. State Document.

The Birds of Florida; containing original Descriptions of upwards of 250 species, with notes upon their habits, etc. By C. J. Maynard. Part I. 4to, pp. 32, and 1 colored plate. Salem. Naturalists' Agency. 1872.

Grevillea, a Monthly Record of Cryptogamic Botany. No. 4. October, November, 1872.

Bulletin of the Torrey Botanical Club. Vol. iii. Nos. 9 and 10. September and October.

Geological Magazine. Vol. ix, Nos. 5-7, May, June and July.

Journal of Botany, British and Foreign, for Sept., Oct., Nov., 1872.

Entomologist's Monthly Magazine for Oct., '72.

Revue Scientifique. Paris. Nos. 12-18. Sept. Oct., Nov., 1872.

Journal of the Franklin Institute. Sept., Oct., Nov., 1872.

Quarterly Journal of Microscopical Science for July and October, 1872.

Journal of the Queckett Microscopical Club for July, 1872.

The American Journal of the Medical Sciences. Philadelphia, Oct., 1872.

The Scottish Naturalist. Perth. Vol. 1. Nos. 6 and 8. Apr. and Oct., 1872.

American Journal Science and Arts. New Haven. Oct. and Nov., 1872.

The Field. London. Nos. for Sept., Oct., Nov., 1872.

Land and Water. London. Nos. for Sept., Oct., Nov., 1872.

The Academy. London. Nos. for Sept., Oct., Nov., 1872.

Nature. London. Nos. for Sept., Oct., Nov., 1872.

Science Gossip. London. Nos. for Sept., Oct., Nov., 1872.

[Our stock of paper made for the NATURALIST was stored in Boston, and was destroyed in the fire. As it would be several weeks before we could have paper made to match we are obliged to use a different quality for these last signatures of the volume. —EDS.]

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